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# Science & Technology

## USSR: Chemistry

JPRS-UCH-89-006

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13 June 1989

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UDC 543.42.062:546.94

**New Indicator Reactions in Weakly Acid and Alkaline Media in Catalytic Methods for Determining Osmium**

18410102a Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 43 No 11, Nov 88 (manuscript received 4 Aug 87) pp 2014-2017

[Article by S. P. Mushtakova, T. P. Kraskova, A. P. Bumenyuk, and Ye. A. Romanova, Saratov State University imeni M. G. Chernyshevskiy]

[Abstract] A study is made of the catalytic effect of osmium (IV) and osmium (VIII) in the oxidation of 4-amino-4'-methoxydiphenolamine by the oxygen in the air and N-methyl-p-aminophenol by hydrogen peroxide in alkaline and weakly acid media. Catalytic methods are developed for determining osmium (IV) and osmium (VIII) that allow determination of  $5 \cdot 10^{-9}$ - $5 \cdot 10^{-7}$  M osmium (IV) and  $4 \cdot 10^{-9}$ - $4 \cdot 10^{-7}$  M osmium (VIII). The methods were used to analyze artificial mixtures and sulfur-sulfide ore flotation tailings. The methods yield an error of not over 5 percent. Figures 3, references 10: Russian.

UDC 543.257.1:546.56:637.1

**Ionometric Determination of Copper in Milk and Dairy Products**

18410102c Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 43 No 11, Nov 88 (manuscript received 24 Jul 87) pp 2036-2038

[Article by V. P. Guskova, I. V. Krupina, and L. S. Sizova, Kemerovo Food Industry Technological Institute]

[Abstract] A study is made of the possibility of using a copper ion-selective electrode for the rapid determination of copper in milk and dairy products. A copper ion-selective electrode and chloride silver comparison electrode were used, with the emf being measured by a digital meter after a constant potential was reached (accuracy, 0.01 mV). The determination method is suitable for the analysis of commercial milk specimens and other dairy products. The analysis time is 15-20 minutes, and the results of the analysis agree well with results obtained by the polarographic method. The method has good reproducibility. Figure 1, references 11: Russian.

UDC 543.8:547.562.2

**Determination of Phenols by Azo-Coupling Reaction With 1-(Fluorenyl-2)-3,3-Diethyltriazene**

18410102e Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 43 No 11, Nov 88 (manuscript received 3 Aug 87) pp 2070-2073

[Article by N. B. Kupletskaya, T. N. Tikhonova, and A. N. Kashin, Moscow State University imeni M. V. Lomonosov]

[Abstract] A method is developed for determining phenols based on the azo-coupling reaction using aromatic and aliphatic-aromatic triazenes as the source of the diazonium cation. When treated with oxygen, the triazenes are converted to the corresponding diazonium cations, which are then used in the azo-coupling reaction with the phenols. The triazene to be used as the diazonium cation source must meet several requirements: it must be capable of rapid conversion to the diazonium cation in HCl vapor; the color of the diazonium cation and its decomposition products must not mask the color of the azo dye; and the triazene should be crystalline for convenience of purification, storage, and charge preparation. The method allows rapid semiquantitative or quantitative determination when using 1-(fluorenyl-2)-3,3-diethyltriazene as the source of the fluorenyl-2-diazonium cation. The interval of concentrations of phenol solutions that can be determined is  $5 \cdot 10^{-5}$ - $5 \cdot 10^{-3}$  M. References 5: 2 Russian, 3 Western.

UDC 547.45.06:535.379

**Determination of Small Quantities of Phenols by Increased Chemiluminescence of Luminol in Reaction With Hexacyanoferrate (III)**

18410102f Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 43 No 11, Nov 88 (manuscript received 15 Jul 87) pp 2074-2078

[Article by I. Ye. Kalinichenko, T. M. Tkachuk, and A. T. Pilipenko, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study is made of the possibility of using the increasing chemiluminescence upon oxidation of luminol by hexacyanoferrate (III) to determine small quantities of phenols. It is found that the chemiluminescence of luminol in a reaction with  $K_3Fe(CN)_6$  at pH 12 increases upon the addition of most of the phenols studied, particularly resorcinol, as well as hydrazine, ascorbic acid, and other reducers. Compounds that react slowly with  $K_3Fe(CN)_6$ , such as fructose and other carbohydrates, glycerin, citric, salicylic and other oxyacids, formaldehyde, ethylene diamine, thiourea, dimethylglyoxime, and acetyl acetone have no significant influence on the reaction at concentrations of not over  $10^{-5}$  M. Aniline, hydroquinone, and a few other reducing agents inhibit the chemiluminescence of luminol, even when resorcinol is present. The reaction is used to determine phenols with a detection limit of  $10^{-10}$ - $10^{-7}$  M. The addition of  $OsO_4$  greatly reduces the influence of the phenols that inhibit the reaction. Figures 3, references 11: Russian.

UDC 66.021.4:665.658.4

**Heat Transfer in a Nonmoving Granulated Catalyst Layer**

18410104a Leningrad ZHURNAL PRIKLADNOY  
KHIMII in Russian Vol 61 No 11 Nov 88 (manuscript  
received 5 Jun 87) pp 2442-2446

[Article by N. M. Aliyev, F. V. Aliyev, N. M. Torgovitskaya, R. A. Rzakuliyev, and I. M. Babayev, Institute of Petrochemical Processes imeni Yu. G. Mamedaliyev, Azerb Academy of Sciences]

[Abstract] A study is made of granulated iron-containing oxide catalysts used in the dehydrogenation of olefin C<sub>4</sub>-C<sub>5</sub> hydrocarbons. Experiments were performed in two cylindrical apparatus with heated walls and various charge heights of catalysts over a broad range of Reynolds numbers. Experiments determined the radial temperature profile in the flow at the exit from the layer and at various heights within the layer. The experiments, plus two-dimensional modeling, were used to analyze heat transfer in the nonmoving granulated catalyst layer. The heat-transfer parameters of the two-dimensional model were converted as a function of flow rate, equipment diameter, and particle size. Final processing of the data was used to produce empirical equations to determine the heat transfer coefficient at the wall of the apparatus and the radial heat conductivity coefficient of the layer. Figures 4, references 10: 6 Russian, 4 Western.

UDC 547.546:542.941.7:001.57

**Mathematical Modeling of Aromatic Aminohydride Synthesis in Catalytic Reduction of Nitro Compounds by Hydrogen**

18410104b Leningrad ZHURNAL PRIKLADNOY  
KHIMII in Russian Vol 61 No 11 Nov 88 (manuscript  
received 4 Dec 87) pp 2446-2449

[Article by M. V. Dorogov, M. Ye. Basner, A. K. Kobayakov, Ye. R. Kofanov, and G. S. Mironov, Yaroslavl Polytechnical Institute]

[Abstract] A study is made of problems of mathematical modeling of the catalytic reduction of aromatic nitroanhydrides by hydrogen under pressure in an inert organic solvent with a palladium catalyst. The purpose of the study was to allow prediction of the operating characteristics of pilot-scale and industrial-scale batch reactors used to synthesize compounds of this class under these conditions. The experimental data indicate the change in  $\tau$  upon variation of reagent concentration. A comparison of calculated data with experimental data from a pilot-scale apparatus confirms their adequacy and the suitability of the kinetic model produced for prediction of the operating characteristics of a batch reactor. References 8: 6 Russian, 2 Western.



### Chemical Exhibition Reveals Availability-Capability Gap

18410132b Moscow SOTSIALISTICHESKAYA  
INDUSTRIYA in Russian 29 Dec 88 p 4

[Article by Ye. Kolesnikova and V. Lagovskiy: "All-Powerful but Powerless Chemistry"]

[Text] There are over 2,000 exhibits at the "Chemistry and Acceleration of Scientific and Technical Progress" exhibition.

Chemistry is truly all-powerful—it creates materials having no equals in nature, it protects the harvest, it cures people, cleans parts, washes, paints and, finally, whether we like it or not, it provides us food and drink, and it shods and clothes us. But this is only a first impression. The more attentively the visitor acquaints himself with the exposition, the more frequently he recalls Nekrasov's verses: "...you are both mighty and powerless...." What sort of acceleration can we talk about when we learn that a fabulous exhibit was created only for show and that it will remain the sole and unrepeatable specimen for a decade to come? It appears that the organizers of the exhibition have themselves finally decided to answer the question as to how to lay a bridge between chemistry, which "can do all," and the sector that has been called upon to transform the accomplishments of science into specific articles available to the ordinary customer.

### Report by Our Special Correspondents From the Exhibition of the Achievements of the USSR National Economy

Over 900,000 square meters of polyethylene film and 328 film-making machines were produced in 1987. The economic impact from their use is 42 million rubles.

Much has been written about the remarkable possibilities of polyethylene film. But one need only see for oneself what they can do to be astounded once again.

"Are those real apples?" we asked about fruit in a polyethylene bag beaded with moisture.

"But of course!" smiled Polimersintez Scientific-Production Association senior engineer L. Klimov. "They're now in their second month of storage here without a refrigerator, out in the open, but they are still juicy and tasty-looking."

Polyethylene films purify industrial wastes and freshen seawater, ultrapure substances are obtained with their help in the electronics industry, and they are widely employed in medicine—from "artificial kidney" machines to quick blood analysis.

"And these are completely new products," Larisa Alekseyevna continued, "'Antey' and 'Samson' concentrated protein beverages. They are assimilated in a few minutes, and they are a highly effective energy source. It is no wonder our Olympic athletes loved them so much."

We were certain that more than just athletes would like the taste of the nutrient beverages. All the more so because they do not require any special raw materials for their production—just whey, which can be found at any dairy. But alas, while whey is available, the beverage is now being produced by only a few enterprises. What's the matter?

"A typical situation, unfortunately," said Larisa Alekseyevna. "Only a few rare enterprises know about the possibilities of the film, its range, and its cost. The first catalog was finally published this year. It provides details on products of the Membrany Interbranch Scientific and Technical Complex: It gives the areas of use of specific brands of film and their technical data, and the manufacturer's address is indicated. But this publication cannot be said to be complete. Eighteen of the manufacturing enterprises ignored the request of the publishers and did not send any documents on their articles."

That's a pity because advertising can create real miracles. A group of developers at the Polimersintez Scientific Production Association in Vladimir made film impervious to highly concentrated acids and alkalis. The demand for such articles was enormous, but no one of course knew about them. Then V. Karachevtsev, director of the cost-accounting laboratory, decided to try advertising. It cost around 20,000 rubles. And now they can't keep the customers away, and orders are coming in from the entire country and from abroad. The wages of the laboratory's associates have increased by three to three and a half times, and the semiannual bonuses attained 1,000 rubles. What can we say? If you want to make money, spend money.

In the last 2 years, the total discharge of toxic substances into the atmosphere was reduced by 10 percent, while enterprises of the chemical complex have reduced discharges by 16 percent.

There is a little green square at the center of the pavilion. Is it there just for interior decoration? No, it is an exhibit of the USSR Academy of Sciences Botanical Garden. Scientists selected and developed plants that adapt easily to polluted soil and atmosphere and trap many toxic impurities. Living "filters" are a good thing—our only concern is that they do not become the sole representatives of our forests and fields in the future.

The sector's specialists spoke with us proudly: Among enterprises that contaminate nature, chemical plants are far from being the leaders. They are more likely the outsiders, occupying 18th place. Is this so? But what is important is not to rank the harmful production operations but rather to get rid of them in general. Projects

displayed by scientists in the "Environmental Protection" section persuade us that chemistry can do a great deal in this regard. After all, for every poison there is an antidote—even the pesticides, phenols, mercury, and heavy metal ions that everyone fears can be broken down. The exposition describes various methods, one better than the next. Thus, it is all the more vexing that competition is presently limited basically to ideas and, in the best case, to experimental models. And enterprises at which truly wasteless production processes and modern purification methods have been introduced can be counted on the fingers of one hand. One of them is the Khimprom Production Association in Pervomaysk. The output capacity of the waste treatment system operating here can service an entire city. Discharge of contaminated water into the river was completely stopped after it was placed into operation. Following treatment in several stages, domestic sewage is routed to the enterprise and then back to the treatment plant. The association employs a closed cycle. An automatic system monitors water quality. Fertilizer valued at almost 5 million rubles per year is made from trapped substances.

There are also other enterprises where an effort is made to treat the environment carefully. Their addresses are indicated in an exhibit. But the chemical complex is enormous, and the addresses are few.

**There are plans for building 39 new drug enterprises and rebuilding and expanding 48 existing ones. This will make it possible to almost triple production.**

The medical section is one of the largest at the exposition. But the abundance seen at the exhibits can no longer mislead anyone—all of us have been to the pharmacies. And yet the graphs accompanying the exposition assure us that the demand for medicines is now already 80-90 percent satisfied. The curves reach the 100 percent mark in 1993. Does that mean that in 4 years there will be enough medicine for everyone?

"This refers primarily to the necessary minimum," said L. Dorofeyev, deputy general director of the Med-bioekonomika Scientific-Production Association, explaining the graph. "This basically represents those preparations that the industry launched into production long ago."

True, there are different kinds of drugs. When a cold comes on, for example, one might get by with aspirin, or one might use effective antiviral drugs—an extremely broad assortment of them are displayed. And not just for colds—there are drugs here for pneumonia, dysentery, asthma, hepatitis—it would be impossible to list all of the diseases. Take for example the new method of treating tuberculosis. It is gentle to the body. Before, in order to get medicine to afflicted lungs, blood had to be saturated with a drug, and this was dangerous. Specialists at the All-Union Scientific Research Institute of Medical Polymers proposed a way of delivering the medicine right to the target—to the focus of the disease.

The drug can be sprayed right into the pulmonary chamber by means of a special set of polymer instruments. But where can any of this be found? What pharmacies carry this equipment, and what polyclinics and hospitals use it?

We know how to make polymer films and aerosols, prosthetic bandages, resorbable thread for surgical sutures, and plastic containers for blood transfusions no worse than the kind delivered to casualties in Armenia from abroad. There are also thermometers at the exhibition that are simply applied to the skin. They are simple devices, but the demand for them is only a third satisfied in the best case. In a word, the exhibits illustrate the successes of scientists well—both medical specialists and chemists. The accomplishments of industry are less noticeable.

"Raw material shortages, obsolete equipment," L. Dorofeyev complains. "There is no output capacity reserve with which to flexibly react to changes in demand—the enterprises are loaded to the limit."

We should add that there is no real economic interest in changing anything either. The latest drugs and instruments are a burden. This diagnosis is known, but the cure is known as well—we need other methods of business management.

**The assortment of household chemical articles includes over 800 items, and 40-50 new items are introduced into production each year. Eighty percent of chemical fibers are used to produce consumer goods.**

One visitor to the exhibition could not refrain from commenting after inspecting this section: "I think they're just making fun of us. 'Geya,' 'Azhar,' 'Modena'—the names they think up are so poetic, but you can't find ordinary toothpaste in the stores."

We must admit that we also experienced similar feelings after looking at the "Chemistry for the Home" exposition. Shampoos containing exotic additives such as peat wax and fennel oil dazzled the eyes. The fragrance of the laundry detergents penetrated even the glass showcases. Lipsticks of the most fashionable shades were displayed next to elegant cosmetic kits containing eye shadows, deodorants, and blushes.

It was not so much the abundance that astounded us—what astounded us was that these were not at all the latest articles. Many of them, as it turns out, have been in production for a long time, but in laughably small quantities. And we thought they were new. But then, what can you think when you see them for the first time at an exhibition?

Would you like to know why toothpaste is in short supply? Just read the notes accompanying the exhibitions—they are quite eloquent. As it turns out, many of the ingredients and raw materials used in toothpaste are not produced in our country at all. And they never have been.

Things are no better with cosmetics and perfumes. Legends with the same old explanations are to be found everywhere: "The raw materials are not produced," or "The raw material demand is not satisfied." To be able to saturate the perfume market, we would need about eight basic ingredients. Seven of them are not produced in our country, while the eighth is available. All we need is but a ton a year, and still the sign says, "The demand is not fully satisfied."

The typical visitor to the exhibition is troubled not so much by the question as to why not. What is important for him to know is when the demand will be satisfied. Here at the exhibition he is able to see an entirely different attitude toward business. Exhibits of the Sovitalplastik joint venture were brought to the exhibition directly from the company store. Excellent toys, plastic dishware, shelving, and room ornamentation.

"Tashkent has already been saturated with our products," complains process engineer I. Panafenova. "Soon we will be opening company stores in other cities."

Imagine that chemists in Tashkent have no problem with raw materials and dyes. And they don't have to buy anything from abroad, from their Italian partners. This is what makes the prices of the articles reasonable. For example, a light pink bath set consisting of six articles costs 20 rubles, and a plastic dishware set that any housewife would like costs 23.

We left with a nagging question in our minds: Was this section named appropriately? Chemistry for the home? Or, should it have been called "chemistry for the exhibition"? Moreover, the entire exhibition elicited many questions. Mainly, when will we finally see this abundance not only in exhibition displays, and when will it become available to all? We went to the sector's headquarters for the answer.

#### Comments by USSR Deputy Minister of Chemical Industry V. Torbenko

[Question] Viktor Mikhaylovich, we must honestly admit that we were amazed primarily by the information accompanying the displays. Rather than the usual explanations of the exhibits, we found open admissions—one is unavailable, another is in short supply, a third is not to be had at all. Why this approach to the ordinary citizen? The impression is that the exhibition's organizers are making an appeal not to visitors but to workers of the USSR Gosplan.

[Torbenko] Public opinion is acquiring increasingly greater importance in our times. And so we decided to demonstrate the might and generosity of chemistry and describe new production processes, materials, and articles. And at the same time, to demonstrate that for all of this to appear we need sizable capital investments. The chemical industry cannot do without them today. And without the chemical industry, it is impossible to accelerate scientific and technical progress in general.

[Question] That's probably what every department feels. But where are these assets to be found?

[Torbenko] Perhaps we need to reexamine the distribution of budget allocations among the sectors. For example, steel production is developing as intensively as before. But cheaper polymers can replace metallic articles and structures in many cases. There is an airplane at the exhibition that consists of 70 percent polymers. A ton of polymers can replace 3-4 tons of metal at motor vehicle plants and concurrently reduce the energy requirements of their production operations as well. According to estimates by specialists, modern plastics are capable of saving 100 million tons of ferrous and nonferrous metals and releasing a tenth of the presently operating machine tools and woodworking machines and about 2 million workers for other purposes. As you can see, chemistry can definitely make a positive contribution. But I repeat, without investments, miracles will not occur. In order to completely satisfy the national economy's demand by 1995, around 40 billion rubles of capital will have to be invested into the chemical industry. These assets are needed in order to rebuild and modernize obsolete enterprises, build new ones, provide equipment to them, and support production with raw materials. But this would allow us to carry out only the most urgent, priority tasks. We also need to look to the future. And this means laying a sound technical and technological foundation in the sector and actively developing chemical machine building. The latter is not spoiling us with its support. Out of 400 units of equipment needed for the production of household chemical goods, in 17 years we have received only 37. The example is indicative, but it is not at all the only one.

Things are especially complex today, now that the mechanism of rigidly funded, centrally distributed equipment is already breaking down while wholesale trade in production equipment has not yet gathered momentum.

Under these conditions we are especially sensitive to the dictates of the equipment producers. And our own machine building base is very weak. I am certain that, if we are not to find ourselves in as impoverished a position in the future as today, first of all we would need to reexamine the priorities in the machine building complex in favor of producing chemical equipment, and secondly we would need to create our own machine building base in our sector. But for the moment we are investing the money we earn into the creation of joint

ventures within the USSR Ministry of Chemical and Petroleum Machine Building. Thus we recently created the Soviet-American company "Dresser—Soviet Engineering."

[Question] Everyone is concerned by the shortage of household chemical goods. When will it be surmounted?

[Torbenko] Before looking into the future, let's analyze the situation as it now stands. Strange as it may seem, this year we completely satisfied the orders from the trade system. For example the plan for producing synthetic washing agents was surpassed by as much as 5,000 tons.

[Question] Perhaps the trade system made a mistake when it placed its orders. But is it really that hard to increase production?

[Torbenko] It is impossible for us to build new plants quickly and to reorient an entire sector on an emergency basis. I am certain that the most reasonable thing to do today would be to uniformly distribute the available household chemical products, move them out of the plants, and organize efficient transportation. But please don't think I'm trying to avoid the issue. For example in Baku and Central Asia the shortage you're talking about does not exist, while in Leningrad this is the second year that the supply of toothpaste has been irregular. There is a psychological factor working here. As if on command,

customers have been hoarding laundry detergents, shampoo, and soap. We cannot fill the gap instantaneously. But when such speculative behavior settles down, I guarantee that the acute shortage will disappear. By 1990 we will completely satisfy the demand for synthetic washing agents and bleaches. But alas, we will continue to experience a shortage of aerosols, spot removers, and perfumes for creams and shampoos. Why? I think I already answered that question at the start of our talk.

[Question] And finally, Viktor Mikhaylovich, a traditional question—about the mutual relationships between chemistry and ecology.

[Torbenko] Our ministry was the first to propose the integrated "Ecology" program. We already know which enterprises pollute the environment where and how. We also know how they process these wastes. By the year 2000, plants of the chemical complex will completely halt the discharge of liquid wastes. Sizable assets have been allocated in order to transform existing enterprises into ecologically clean production operations. And wasteless production processes have been designed into future production operations.

Given the present rate of scientific and technical progress, only chemistry can become the main protector of nature. After all, not a single sector of the national economy is capable of processing toxic substances without the assistance of chemical processes. Protection of the environment also requires sizable assets, estimated at over 20 billion rubles.

UDC 541.138-183

**Adsorption of CO<sub>1</sub> on Platinized Platinum Electrode**

18410099a Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
7 Apr 88) pp 73-77

[Article by A. V. Shlepakov, V. N. Andreyev, and V. Ye. Kazarinov, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] The goal of this study was to determine the stoichiometric composition and properties of CO<sub>2</sub> adsorption products, the so-called (CO<sub>2</sub>)<sub>red</sub> by using complex radioisotopic (adsorption) and impulse electrochemical measurements. It was shown that a change in the CO<sub>2</sub> adsorption potential did not have any effect on the anode potentiodynamic curves; a new property of chemisorbed particles with the stoichiometric composition COH was observed, namely, that the particles are adsorbed on the platinum surface in two forms that differ in their electrooxidation potentials. The relationship between these two forms is determined only by the total quantity of adsorbed product. The COH particles that form during adsorption of either CO<sub>2</sub>, methanol, formaldehyde or formic acid have identical properties. Figures 5; references 22: 1 Russian, 11 Western.

UDC 541.138-183

**CO Adsorption on Platinized Platinum**

18410099b Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
7 Apr 88) pp 78-85

[Article by A. V. Shlepakov, V. N. Andreyev, and V. E. Kazarinov, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] In spite of numerous studies in the past 20 years of the adsorption of CO on platinum, the data are still contradictory. Adsorption of CO on platinized platinum from a 0.5 M H<sub>2</sub>SO<sub>4</sub> solution was investigated by a complex methodology combining a radioisotope method and an impulse potentiodynamic method. It was shown that, in the entire range of studied potentials, the principal product was a CO particle occupying two adsorption sites and yielding two electrons during its oxidation. The presence of two electrooxidation products is due to the difference in their energy states: particles being oxidized at 0.45 V appear on the surface of the electrode only after 50 percent of the surface is already occupied with particles oxidized at 0.75 V. These CO adsorption products differed from the adsorption products of CH<sub>3</sub>OH, CH<sub>2</sub>O, HCOOH, and CO<sub>2</sub>. Figures 4; references 36: 11 Russian (1 by Western author), 21 Western.

UDC 541.138

**Proton Transfer on Nickel Oxide Electrode**

18410099c Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
12 Apr 88) pp 86-93

[Article by B. B. Yezhov, O. G. Malandin, and S. N. Kuoryashov, Scientific Research Institute of Chemistry, Saratov State University imeni N. G. Chernyshevskiy]

[Abstract] A method to analyze data of thin-layer chronoamperometry with a gradual change in the potential and proton transfer on the hydroxide/electrolyte interface was reported. By using this method, the effect of the electrolyte composition (solutions of LiOH, NaOH, KOH) and cobalt hydroxide deposited on a nickel oxide electrode was evaluated regarding the proton transfer processes. A mathematical model was used in analyzing the processes occurring in a thin-layer nickel oxide electrode. The model took the final proton transfer rate at the hydroxide-electrolyte interface into account. The transfer coefficient, transfer rate constants, exchange current, and proton diffusion coefficient in solid phase were determined for the crystalline structure of nickel β-hydroxide. Figures 5; references 34: 19 Russian, 15 Western.

UDC 621.315.592:541.14

**Photoelectrochemical Processes on CdSe-ZnSe(ZnS) Electrodes with High-Intensity Illumination**

18410099d Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
9 Dec 87) pp 124-126

[Article by G. Ya. Kolbasov, T. S. Chornokozha, S. K. Kovach, N. I. Taranenko, A. T. Vasko, and I. K. Ostrovskaya, Institute of General and Inorganic Chemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] Experimental results were reported of a study of the photoelectrochemical properties of thin-layer CdSe electrodes plated with ZnSe (ZnS) by using a light beam imitating sunlight. The determinations were carried out in a photoelectrochemical cell in which the electrolyte flow could achieve a velocity of 810 ml/min. CdSe and ZnSe films were chemoprecipitated on a Ti-support, followed by heating to 450-470 °C for 30 min in air. Analysis of the data showed that in this experimental system the most probably mechanism of current passage is one utilizing the pores in the wide zone of the semiconductor ZnS, where the diffusion process of photogenerated holes in CdSe occurs along the CdSe-ZnS heterostructural border. This mechanism explains the degradation of a CdSe-ZnS photoelectrode at a lower light intensity than for the CdSe film because of an increase in local current density. It was also noteworthy that after the charge was passed through the K<sub>eff</sub> of

CdSe-ZnS electrodes diminished by 10-15 percent, analogous to the case of chemically precipitated CdSe films. Figure 1; references 10: 5 Russian, 5 Western.

UDC 541.14

**Accumulation of Photoinduced Anode Charge in Polycrystalline Films**

18410099e Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
9 Dec 87) pp 126-128

[Article by S. K. Poznyak and A. I. Kulak, Scientific Research Institute of Physiochemical Problems, Belorussian State University, Minsk]

[Abstract] Photooxidation-reduction processes, which were studied on  $\text{Bi}_2\text{O}_3$  crystalline anode films possessing a high density of electron traps (ET), expressed transitional photoelectrochemical behavior and an ability to retain the charge accumulated by the traps.  $\text{Bi}_2\text{O}_3$  films 10-250 nm, thick were obtained by the anodic oxidation of bismuth on 0.1 M NaOH followed by crystallization utilizing thermal treatment in argon at 220 °C for 30 min. The experiments showed that, during the flow of anode current through the polycrystalline  $\text{Bi}_2\text{O}_3$  films, an accumulation of photoinduced positive charge occurred in the oxide; this charge is retained for a long time under conditions of an "open chain" and can be determined by the magnitude of the cathode charge moving toward the cathode during the charge in electrode potential. A model was developed based on the assumption that photogenerated holes destroyed localized electron states (traps) on the surface and subsurface area of  $\text{Bi}_2\text{O}_3$ , after which they were filled with dark electrons from the C-zone of the oxide. This preservation of a photoinduced positive charge (up to several days), characterizing the memory effect, should have increased with lowered volume concentration of free electrons in the oxide and with their diminished mobility. Figures 2; references 7: 4 Russian, 3 Western.

UDC 541.14

**Accumulation of Photoinduced Anode Charge in Amorphous Films**

18410099f Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
17 Dec 87) pp 129-131

[Article by S. K. Poznyak and H. I. Kulak, Scientific Research Institute of Physiochemical Problems, Belorussian State University imeni V. I. Lenin, Minsk]

[Abstract] In a continuation of their studies, the characteristics of the accumulation of a photoinduced positive

charge in amorphous  $\text{Bi}_2\text{O}_3$  films were investigated. These films did not contain a space charge region, the concentration of free charge carriers was low, and their mobility was anomalously low. It was shown that, analogously to the polycrystalline films, the accumulation of a photoinduced positive charges also occurs in the amorphous  $\text{Bi}_2\text{O}_3$ . While the crystalline material could reestablish the photoinduced state by a shift in the potential even in the dark, amorphous films could only obtain this while illuminated with light in the specific absorption range of the oxide. This difference could be due to various limiting stages of this process: in the amorphous films with a low concentration of free charge carriers this process is limited by the light-induced generation of free electrons in the entire volume. Extended retention of the charge indicates that higher states of oxidation  $\text{Bi}_2\text{O}_3$  may form, such as  $\text{Bi}_2\text{O}_5$  in the subsurface region of  $\text{Bi}_2\text{O}_3$  electrodes. Figures 3; references 4: 2 Russian, 2 Western (1 by Russian authors).

UDC 542.8:542.973

**State of Raney Catalyst Surface From CdSe-ZnSe(ZnS) Alloys**

18410099g Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 1, Jan 89 (manuscript received  
29 Jan 88) pp 134-137

[Article by V. G. Shalyukhin, G. L. Padyukova, A. Sh. Kuanyshev, and A. B. Fasman, Institute of Organic Catalysis and Electrochemistry, KazSSR Academy of Sciences, Alma-Ata]

[Abstract] The adsorption properties and the state of the surface of Pt-Raney catalyst modified with Zr, V, Cr, and Mo were studied. All of these additives become fully oxidized and leach out into solution in the course of the preparation of the catalysts. Analysis of freshly prepared catalysts showed that these additives were in the oxidized state and occupied different portions of the surface. These additives showed little effect on the energy contours of the Pt surface. The effects of individual additives on the properties of Pt-Raney catalysts were described. Overall, the effect of these additives on the catalytic properties intensified in cases where a chemical interaction existed between these components in the starting alloy. Such catalysts were much more stable than normal Pt-Raney catalyst when used in electrochemical cells. Figures 2; references 9: 7 Russian, 2 Western (2 by Russian authors).

**Explosion Rumors Follow Kiev Chemical Spill**  
*18410132d Moscow SOTSIALISTICHESKAYA  
INDUSTRIYA in Russian 14 Jan 89 p 2*

[Article by Zh. Tkachenko: "While an Explosion Did Not Occur..."]

[Text] No matter where I went that day, everyone asked me about an explosion in the vicinity of the rail terminal, which supposedly occurred on Friday, January 6. Rumors circulated in the subway cars, streetcars, and homes. The talk was that tanks containing some kind of toxic gas had blown up. This compelled me to telephone people in the know, but I was told by the railroad administration that no tanks of any kind had exploded on the railroad. And yet the city was buzzing just before the weekend: People called the newspapers, the press center, and the Ministry of Public Health, asking what to do with their children.

And once again, where there was smoke, there was fire. It turned out that the bottom of a capsule containing powdered thallium, used to monitor water quality in heating systems, had unexpectedly fallen off in the boiler room of an aircraft repair plant. The instructions require cleaning the preparation from time to time by immersing the capsule into a hydrochloric acid solution. This time the powder escaped from the capsule into the solution.

"This solution is presently being stored in a sealed container, and it will be interred in accordance with the established rules," explained V. Shestakov, Kiev's chief state public health physician.

That means a false alarm. Scientists of the All-Union Scientific Research Institute of Hygiene and Toxicology of Pesticides, Polymers, and Plastics and of the Institute of Labor Hygiene and Occupational Diseases of the republic's Ministry of Public Health feel that there is no danger to the public or equally of contamination of the air around the territory.

All's well that ends well—but it would be still better if we knew why capsules that must be hermetically sealed fall apart.

What all of this meant was that the citizens of Kiev did not rest very easy last Saturday and Sunday. In each such case, whether an explosion occurred or not, whether an incident occurred or not, there should be some kind of official service providing warning and notification.

UDC 546.214:547.82:543.87

**Destructive Oxidation of 4-Aminopyridine by Ozone in Aqueous Media**  
*18410093a Kiev KHIMIYA I TEKHOLOGIYA VODY  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 25 Jul 87) pp 390-392*

[Article by S. S. Rudyak, N. M. Soboleva, Ye. G. Solozhenko, and V. V. Goncharuk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Duman-skiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study is made of the kinetics of the ozone oxidation of 4-aminopyridine and of the possibility of intensifying the process by selecting optimal ozonation conditions and using transition metal sulfates as catalysts. It is shown that the rate of oxidation depends essentially on the acidity of the initial solution, which increases as the pH increases. The absorption of ozone increases as the pH increases after the initial reagent is consumed because of the further oxidation of the initial ozonation products. In alkaline and neutral media, the oxidation of 4-aminopyridine is accompanied by decreases in the pH of the solution. Ozonation in aqueous solutions involves the formation of ammonia. 4-Aminopyridine is rapidly decomposed in the presence of  $\text{VOSO}_4$ , with deep destruction of the heterocyclic ring. Figures 4, references 12: 4 Russian, 8 Western.

UDC 541.15+541.183+536.658.2

**Sorption of Samarium on Alkali-Earth Metal Carbonates From Sodium and Potassium Chloride Solutions**

*18410093b Kiev KHIMIYA I TEKHOLOGIYA VODY  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 25 Jul 87) pp 393-395*

[Article by V. I. Maksin, N. Ya. Gudzh, O. Z. Standritchuk, and Ye. L. Martsenyuk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Duman-skiy, Ukrainian Academy of Sciences; Kiev University imeni T. G. Shevchenko]

[Abstract] Data are presented from a systematic study of the sorption of samarium from sodium and potassium chloride solutions based on magnesium, calcium, strontium, and barium carbonates. The data are used to compose a selectivity sequence of alkali-earth metal carbonates for sorption of samarium from the following solutions:  $\text{MgCO}_3 \cdot n\text{H}_2\text{O}$ — $\text{SrCO}_3$ — $\text{BaCO}_3$ — $\text{CaCO}_3$  (in decreasing order of selectivity). The ion-exchange mechanism seems to play the dominant role in sorption of samarium by the carbonates. Figures 3, references 7: 6 Russian, 1 Western.

UDC [628.543.12:547.391.3:543.544]+543.3

UDC 628.162.82

**Chromatographic Determination of Crotonic Acid in Natural and Wastewaters**

18410093c Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 22 Jun 87) pp 410-411

[Article by L. I. Gosteva, and V. F. Fedonina, Monomers  
All-Union Scientific Research and Design Institute,  
Tula]

[Abstract] The gas chromatography method is used to determine crotonic acid, a lower unsaturated organic acid, in free form. To determine microscopical quantities of the acid in air, it was extracted from acidified water specimens by salting out with sodium chloride. Conversion to the organic phase avoids false peaks in gas chromatographic analysis. The influence of various impurities in natural and wastewaters on the determination of crotonic acid was studied. It was found that the following do not hinder the determination (provided they are used at not more than 10-20 times their maximum permissible concentrations): petroleum products; detergents; phenols; methanol; carbon tetrachloride; acetic, formic, and humic acids; and crotonaldehyde. Figure 1, references 6: 4 Russian, 2 Western.

UDC 547.45:534.544:614.7

**Gas Chromatographic Analysis of Polar High-Boiling-Point Components in Oxyacetyl Compound Production Wastewaters**

18410093d Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 24 Jun 87) pp 411-415

[Article by M. A. Dubovik, V. K. Yatsimirskiy, and A. N. Korol, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] The purpose of this work was to create a gas chromatographic method to analyze polar high-boiling-point components in oxyacetyl compound wastewaters at the maximum permissible concentration. Glass capillary columns were used to achieve the greatest separation effectiveness. Periodic silanization of the column and dose meter, installation of fresh glass wool in the dose meter, and its silanization were used to achieve stable results. Two internal standards were used to measure the relative values of retention: Sec-butylbenzene and 1-methylnaphthalene. Figures 2, references 9: 4 Russian, 5 Western.

**Principle of Developing Process and Contact Equipment for Ozonation of Natural and Wastewaters**

18410093e Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 16 Feb 88) pp 416-423

[Article by R. R. Munter, Tallin Polytechnic Institute]

[Abstract] A flowchart is presented for the development of contact equipment for the ozonation of water, including investigation of the ozonation process under laboratory conditions, selection of the type and design of contact equipment, development of a mathematical model of the equipment, and optimization of the operation of the contact equipment with respect to concentrations of substances in the water at the intake. The method is used to design simple equipment that operates reliably, including a direct-flow screen-type apparatus. The apparatus is a promising design for the contact ozonation of natural and wastewaters. References 15: 9 Russian, 6 Western.

UDC 541.133

**Deep Purification of KU-2-8 Cationite of Heavy Metal Ions and Organic Substances**

18410093f Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 3 Jun 87) pp 433-435

[Article by A. T. Pilipenko, V. D. Grebenyuk, V. G. Safronova, I. I. Penkalo, L. V. Zakrevskaya, and R. D. Chebotareva, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] This article reports on a study of the possibility of the deep purification of technical-grade KU-2-8 cationite to remove heavy metal ions and organic substances by chemical and electrochemical conditioning. Heavy metal ions were extracted by elution in 5M HCl. The influence of the quantity of electricity passed through the cationite, the lactic and hydrochloric acid concentrations, and the volumetric ratio of acid to cationite on extraction of heavy metals was studied. It was found to be best to use 3-5M HCl with an oxygen feed rate of  $2.7 \cdot 10^{-5}$  m/s and with a triple excess of hydrochloric acid volume to cationite volume. Figures 3, references 8: Russian.



UDC 621.359.7

**Demineralization of Mine Water by  
Electrodialysis**

18410093g Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 17 Dec 87) pp 441-444

[Article by A. P. Krivoruchko, M. I. Ponomarev, O. R. Shendrik, and V. D. Grebenyuk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Duman-skiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study is made of the process of demineral-izing mine water with the simultaneous production of concentrated brine over a broad range of salt content of the dialysate—up to 0.2 g/dm<sup>3</sup>. An equation is derived for the transfer of components through the membrane during electrodialysis; it is shown that a decrease in the initial salt content of the water treated significantly decreases the maximum permissible concentration of the brine by decreasing the yield of salt ions per unit of current and increasing the electroosmotic transfer of water. Figures 3, references 11: Russian.

UDC 628:677.31.027

**Removal of Chromium Compounds During  
Coagulation of Wastewater From Wool Dying and  
Finishing Shops**

18410093h Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 17 Jul 87) pp 444-447

[Article by E. P. Fazullina, B. G. Nazarov, and T. G. Neklyudova, Central Scientific Research Institute of the Wool Industry, Moscow]

[Abstract] An economical method is suggested for the simultaneous removal of chromium compounds, dyes, and surfactants from wool dying and finishing shops. The method entails using iron sulfate, a waste product from the metallurgical industry. The suggestion is based on the ability of iron sulfate to reduce Cr (VI) to Cr (IV) and its capability for precipitation of chromium (III) hydroxide formed in an alkaline medium. This article studies the influence of dyes and surfactants on the degree of extraction of Cr (VI) and the influence of surfactants and Cr (VI) on the degree of extraction of dyes from wool dying and finishing shop wastewaters by using the iron sulfate method. It is found that the presence of surfactants and Cr (VI) increases the dose of coagulant required to clarify the wastewaters. A 100 percent removal of Cr (VI) from wastewaters can be achieved in an alkaline medium at pH 9 with an initial ratio of iron sulfate to Cr (VI) of 12.5:1. It was also discovered that surfactants up to 100 mg/l and dyes up to 20 mg/l did not influence the degree of extraction of Cr (VI). Figure 1, references 2: Russian.

UDC 541.18.041:628.33

**Compacting Heavy Metal Hydroxide Sediment**

18410093i Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 5 May 87) pp 447-450

[Article by I. A. Vaynshteyn, A. I. Babanina, G. A. Kudenko, and T. M. Shemetova, "Energostal" Scien-tific-Production Association, Kharkov]

[Abstract] A study is presented of the influence of recirculation on the precipitation of particles under the influence of gravitational forces as well as on their structural-mechanical properties and hydrodynamic and filtration characteristics. A sedimentation balance was used to determine the dispersed composition of the sediment, while viscosity was measured by a capillary viscosimeter. Experiments were performed on water containing iron, zinc, nickel, and chromium ions and sulfuric acid. It was found that recirculation and neutral-ization of solutions with a low total concentration of heavy metal cations is effective and allows the produc-tion of a dense sediment of metal hydroxides with significantly improved sedimentation and filtration characteristics. Concentration upon recirculation occurs by significant changes, which are well described from the standpoint of the statistics of clusters by the percolation approach. The direct reason for the closer approach of the particles is the different charge on the surface of the freshly precipitated and recirculated particles. Figures 3, references 7: 6 Russian, 1 Western.

UDC 628.162.534:614.3:576.8

**Effectiveness of Sorption and Coagulation  
Purification of Water To Remove Intestinal  
Bacteria and Viruses**

18410093j Kiev *KHIMIYA I TEKHOLOGIYA VODY*  
in Russian Vol 10 No 5, Sep-Oct 88 (manuscript  
received 29 Oct 87) pp 458-461

[Article by L. V. Grigoreva, O. V. Salata, V. G. Kolesni-kov, and L. A. Malakhova, Scientific Research Institute of General and Communal Hygiene imeni A. N. Marzeyev, Kiev; Kiev Medical Institute imeni A. A. Bogomolets]

[Abstract] A comparative study is presented of the effectiveness of the removal of intestinal bacteria and viruses from waters by clinoptilolite, a coagulant, and a mixture of the two. Thirty-three strains of pathogenic *E. coli* were recently isolated in the Ukraine from patients and various environmental objects, as were two strains of coxsackie and polio viruses. Experiments were per-formed with powdered transcarpathian clinoptilolite at 13.3 g/dm<sup>3</sup> of dechlorinated tap water, aluminum sulfate at 60 mg/dm<sup>3</sup>, and the two combined. The greatest

degree of purification was achieved by using the mixture. This was due to the formation of microorganism-sorbent-coagulant complexes with strong bonds. References 10: 8 Russian, 2 Western.

UDC 628.315.2

**Start-Up and Operation of Miniature Purification Structure**

18410100i Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 1, Jan 89 pp 37-40

[Article by V. N. Deriy, Ye. I. Bobkovskiy, P. D. Bragina, G. A. Goldberg, and G. I. Glazov, Moscow Experimental-Pilot Plant, All-Union Scientific Research Institute of Petroleum Industry, "Orgneftekhimzavody", Institute of Petrochemical Technology, All-Union Scientific Research and Design Institute of Petroleum]

[Abstract] The authors' institutes have developed miniature purification structures for the purification of petroleum-containing wastes, including a settling tank, floatation installation, and biological purification installation. The operation of the installation is described. The installation has been found to be effective, compact, convenient, and economical to service, and it is recommended for refineries and production facilities producing  $1\text{--}3 \cdot 10^3 \text{ m}^3$  of wastewater per day. It is recommended that floating substances be collected from the surface of the settling zones and that excess active silt be removed during operation of the installation. The quality of the biologically purified output water satisfies the standards. Following further purification as called for by the standards, water can be recycled for reuse in the production facility. Figures 4, references 4: Russian.

UDC 539.945

**Transverse Optical Mode and High-Temperature Superconductivity of Metal Oxides With 1-2-3 Structure**

18410105a Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 3-6

[Article by B. Ya. Shapiro, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] In lanthanum cuprites, high-temperature superconductivity results from the interaction of copper-oxygen zone holes with optical phonons due to a distortion of copper-oxygen bipyramids, which form metallic layers in lanthanum-barium-copper-oxygen systems. The metal oxides have a different structure containing both bipyramids and pyramids with a different oxygen environment. Zonal calculations confirm the presence of two types of zones related with both chains and layers in the structure. The critical temperature is not influenced by high optical mode frequencies but does depend strongly on the ordering of oxygen defects in both layers and chains. Supersaturation of chains with oxygen expands the copper-oxygen zone and decreases the critical temperature. Increasing defect concentration causes disordering of the chains, which decreases the density of the states and causes the critical temperature to drop sharply. Other types of ordering are possible with even more narrow zones. Such ordering may be metastable and may be the source of the reported superconductivity at temperatures over 150 K. Figures 3, references 4: Western.

UDC 537.312.62

**High-Temperature Superconductivity in  $\text{Ho}_2\text{O}_3\text{-BaO-CuO}$  Ceramic**

18410105e Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5 Sep-Oct 88 pp 24-27

[Article by K. S. Aleksandrov, G. A. Petrakovskiy, K. A. Sablina, N. I. Kiselev, G. N. Stepanov, A. I. Kruglik, G. S. Patrin, S. B. Petrov, Yu. N. Ustyuzhann, and A. V. Baranov, Physics Institute, Siberian Division, USSR Academy of Sciences, Krasnoarsk]

[Abstract] A report is presented on a study of  $\text{REBa}_2\text{Cu}_3\text{O}_{7-y}$  ceramic, with  $\text{RE}=\text{Ho}^{3+}$  being a function of technological parameters and doping with manganese. The ceramic was synthesized from  $\text{Ho}_2\text{O}_3$ ,  $\text{BaCO}_3$ ,  $\text{CuO}$ , and  $\text{MnCO}_3$  powders. Electrical and magnetic measurements were performed at 4.2-300 K. EPR spectra were measured for all specimens. In addition to the low-field line, the EPR spectra of certain specimens contained an additional weak absorption line with a value of g of

approximately 2, which is attributed to the  $\text{Cu}^{3+}$  ions. The presence of this line indicates the presence of the "green phase" in a specimen, i.e., low quality of the specimen. The high-field EPR line was not seen in true single-phase specimens. Doping with manganese produced a broad absorption line with a value of g of about 2 that was approximately 5 kOe wide at 3 cm. Figure 1, references 3: 2 Russian, 1 Western.

UDC 538.945

**Polarization Pairing of Holes in Disordered Donors—High-Temperature Superconductivity Mechanism in Ceramics**

18410105b Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 7-12

[Article by Ye. V. Kholopov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] A unique mechanism is suggested for superconductivity. The method makes an allowance for the specifics of the structure, chemical bonds, and the system of quasiparticles responsible for the conductivity of the ceramics in question. The mechanism is essentially a nonphonon mechanism, with holes being the only dynamic system. It is an essentially single-zone system, with the hole-type conduction occurring in the valence zone of the oxygen due to the virtual exchange of holes with trivalent copper ions, which causes an instability in the system of holes with random placement of hole donors that in turn leads to superconductive pairing. The hole-polarization mechanism developed can be directly extended to yttrium ceramic structures, with the donor disorder transferred within the unit cell, which indicates the possibility of achieving high-temperature superconductivity in structurally ideal objects. Figures 3, references 19: 8 Russian, 11 Western.

UDC 537.312.62

**Superconductivity of  $\text{La}_2\text{Cu}_{4-8}$  and  $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$  Compounds**

18410105d Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 19-24

[Article by R. Vijayaraghavan, Tata-Institute of Fundamental Research, Bombay, India]

[Abstract] A brief description is presented of the results of measurements of the compounds  $\text{La}_{2-x}\text{M}_x\text{CuO}_{4-8}$  (where  $\text{M}=\text{Ca}$ ,  $\text{Sr}$ ,  $\text{Ba}$ ) and  $\text{RBa}_2\text{Cu}_3\text{O}_{7-y}$ . The influence of annealing conditions on superconductivity was studied in detail. Interesting anomalies were observed in many  $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$  systems. In a specimen of  $\text{Y}(\text{Ba}_{1.6}\text{K}_{0.4})\text{Cu}_3\text{O}_{7-y}$ , superconducting properties were

observed upon initial cooling to 80 K and heating to room temperature. However, upon repeated cooling, "normal" transition to superconductivity was observed at 90 K. Extremely short-lived superconductivity was observed in one specimen of  $\text{YBa}_{1.8}\text{Pb}_{0.2}\text{Cu}_3\text{O}_{7-y}$  in measurements of dynamic susceptibility. The diamagnetic response in the superconducting phase disappeared in less than 30 minutes. A return to the normal state near 25 K was observed upon first cooling. No diamagnetic response was observed upon warming or subsequent thermal cycling. A reproducible magnetic response was observed immediately after the appearance of superconductivity at 90 K in  $(\text{Y}_{0.9}\text{Ca}_{0.1})\text{Ba}_2\text{Cu}_3\text{O}_{7-y}$ . This indicates a magnetic phase transition in this system at a temperature below the superconducting temperature. Measurements made using the four-contact resistance method on a specimen of  $\text{ErBa}_2\text{Cu}_3\text{O}_{7-y}$  indicated a drop in resistance to almost zero at temperatures near 260 K, although this high-temperature anomaly disappeared after the third thermal cycle and superconductivity was observed at the "normal" critical temperature of 90 K in this specimen in subsequent cycles. Figures 5, references 19: Western.

UDC 537.312.62

**Magnetic Properties in Weak Fields and Tunnel Studies in Y-Ba-Cu-O Specimens**

18410105g Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 34-38

[Article by P. P. Bezberkhiy, A. G. Blinov, V. Ya. Dikovskiy, V. G. Dudnikov, A. V. Dudnikov, Z. M. Logvinenko, Eh. V. Matizen, V. A. Moiseyenko, P. P. Samoylov, M. A. Starikov, and V. Ye. Fedorov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences; Institute of Nuclear Physics, Siberian Division, USSR Academy of Sciences, Novosibirsk; Novosibirsk State University imeni Academy of Sciences, Novosibirsk; Novosibirsk State University imeni Lenin's Komsol]

[Abstract] The resistance and magnetic properties of several specimens in the system Y-Ba-Cu-O that were prepared under various conditions with various compositions, temperatures, and annealing times in air were studied. Resistivity was measured by a four-probe potentiometric method, and magnetic susceptibility was determined by a mutual inductance bridge and by a magnetic balance. Long-term annealing in air improves the superconducting characteristics of specimens, while hardening worsens these characteristics. Voltage-current characteristics were studied by using a point-contact method with a niobium needle. The measurements are most consistent with the phonon mechanism of high-temperature superconductivity. Figures 4.

UDC 537.312.62

**Magnetic Properties in Weak Fields and Mossbauer Studies of High-Temperature Superconducting (Y, Ho)Ba<sub>2</sub>(Cu<sub>1-x</sub>Fe<sub>x</sub>)<sub>3</sub>O<sub>7-δ</sub> Ceramics**

18410105f Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 27-34

[Article by A. G. Klimenko, V. I. Kuznetsov, P. P. Samoylov, and V. Ye. Fedorov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences; Institute of Catalysis, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] A study is made of the influence of iron impurities on the superconducting characteristics of high-temperature superconducting (Y,Ho)Ba<sub>2</sub>(Cu<sub>1-x</sub>Fe<sub>x</sub>)<sub>3</sub>O<sub>7-δ</sub> ceramic specimens. The γ-resonance spectra of <sup>57</sup>Fe impurity nuclei were measured, and their magnetic properties were determined in weak constant magnetic fields by means of a squid magnetometer. As the content of iron increases, there is initially a decrease in the temperature at which the diamagnetic moment first appears. Introduction of iron also causes preferential stabilization of the low-temperature phase when there is a small quantity of high-temperature phase present. There is also a significantly smaller difference between the isothermic and thermostatic susceptibility of iron-containing specimens due to the strong influence of iron impurity on the intergranular interaction and suppression of the pinning center. In the intermediate stages of annealing in the systems studied, Fe<sup>4+</sup> and Fe<sup>3+</sup> ions are inserted in the structure in the Cu(I) and Cu(II) positions, and α-Fe<sub>2</sub>O<sub>3</sub> clusters are present, the size of which decreases with increasing annealing time. Iron impurities significantly influence the low field magnetic properties of superconducting ceramics, which can be used to create superconducting Josephson structures with useful properties. Figures 5, references 11: 5 Russian, 6 Western.

UDC 537.312.62

**Phase Transitions Upon Sintering of Y-Ba-Cu-O Superconducting Ceramic and Some Electrophysical Properties**

18410105j Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 62-68

[Article by A. P. Avrorov, A. V. Arzhannikov, I. A. Belitskiy, Yu. V. Seretkin, G. Yu. Shvedenkov, and M. V. Yushkov, Institute of Nuclear Physics, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] This article presents a detailed description of the phase transitions in a Y-Ba-Cu-O superconducting ceramic charge during synthesis of the material. The

structures of the ceramic produced are described, and some of the physical properties necessary to evaluate the prospects for its application are noted. It was found that, as the content of  $Y_2O_3$  in the initial charge increased, resistivity of the superconductor at room temperature also increased from 0.3 mOhm·cm to a few mOhm·cm. The transition temperature was found to be 84-93 K, with the least transition width observed for the specimen with the lowest  $Y_2O_3$  content. The variation in voltage drop as a function of current for  $YBa_{1.5}Cu_{2.2}O_y$  was found to have a step, as described in an earlier work by the same authors. The electron work function for the "frozen" superconductor is found to be at least 6.5 eV. Figures 6, references 6: 1 Russian, 5 Western.

UDC 537.312.62

**Chemical Synthesis and Oxygen Content in High-Temperature  $YBa_2Cu_3O_{7-x}$  Superconductor**  
18410105i Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 55-62

[Article by R. M. Iyer, J. V. Yakhmi, M. D. Sastry, S. R. Dharwadkar, I. K. Gopalakrishnan, and C. M. Phatak, Baba-Center for Atomic Research, Bombay, India]

[Abstract] Some aspects of studies performed at the authors' institute in recent times are discussed, with primary attention given to the following: methods of preparing massive specimens and factors determining homogeneity and high superconducting temperatures, methods of improving values of critical current, studies directed toward determining the nature of superconductivity in compounds mentioned in the title, and the production of thin and thick films by plasma atomization. There are three main methods of producing 1-2-3 compounds. The best results are achieved by coprecipitation of Y and Cu as the oxalates, with barium later added as the acetate. Superconductivity temperatures as high as 106 K with critical current density 200-250 A/cm<sup>2</sup> at 77 K were achieved. In the specimen containing 0.2 percent gadolinium, the critical current at 77 K was 400 A/cm<sup>2</sup>. The authors feel that a single-phase 1-2-3 yttrium-barium-copper compound can achieve zero resistance in the best case at slightly over 120 K. Figures 7, references 9: Western.

UDC 621.315.592:537.531

**Determination of Phase Composition in Superconducting Ceramic by X-Ray Microanalysis**  
18410105k Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 68-71

[Article by A. Ya. Royak, L. N. Mazalov, V. Ye. Fedorov, Yu. G. Lavrentev, P. P. Samoylov, and Yu. I. Mironov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences; Institute of Geology and Geophysics, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] Specimens of superconducting ceramic based on a  $YBa_2Cu_3O_7$  phase were produced in order to study

phase transition processes in the system Y-Ba-Cu-O. Specimens were obtained by sintering pressed tablets of finely ground powders in two stages. X-irradiation of copper, yttrium, and barium was measured in local areas, after which oxygen was determined in the same areas. Examination under an optical microscope showed areas of irregular geometric shape and dark and light spots about 5-10 mm<sup>2</sup> in area. X-ray microanalysis indicated that the chemical composition of these local areas was different: The dark spots were found to be  $Ba_2Cu_3O_7$ , whereas the light spots were found to be  $BaCuO_5$ . Small segregations of secondary phases with up to about 73 mass percent barium content were also found on the surface. Figure 1.

UDC 537.312.62

**Physicochemical and Thermodynamic Properties of Superconducting Cuprites**  
18410105l Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 71-76

[Article by Ya. N. Blinovskov, I. A. Leonidov, A. V. Mirmelshteyn, A. Ye. Karkin, S. A. Lavydov, A. A. Podlesnyak, S. M. Cheshnitskiy, and V. L. Kozhevnikov, Institute of Chemistry, Urals Division, USSR Academy of Sciences, Sverdlovsk]

[Abstract] The equilibrium of point defects is studied for solid solutions of  $La_{2-x}Sr_xCuO_{4.8}$ , in which possible reactions include the replacement of lanthanum ions with strontium ions, an exchange of oxygen with the gas phase, filling oxygen vacancies, localization of holes on copper ions, the formation of associates in the area of high point defect concentrations at low temperatures, and the formation of Schottky defects in  $La_2CuO_4$ . Neutron activation analysis is used to determine the oxygen and copper ion content in anomalous oxidation states as functions of annealing conditions. The temperature variation of the heat capacity of the cuprites was determined in the 3-300 K interval. Figures 5, references 7: 4 Russian, 3 Western.

UDC 537.312.62

**High-Temperature Resistivity and Dilatometry of Superconducting Ceramic Oxide Y-Ba-Cu System Specimens**

18410105m Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 pp 78-84

[Article by V. G. Bessergenev, S. A. Gromilov, V. Ya. Dikovskiy, P. M. Pletnev, P. P. Samoylov, A. V. Tararov, and V. Ye. Fedorov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk; Novosibirsk Institute of Construction Engineering]

[Abstract] A study is made of the resistivity and linear expansion of intermediates used in synthesizing a  $YBa_2Cu_3O_{7.8}$  phase during heat treatment. Curves of

resistivity as a function of temperature differ significantly when measured during heating and during cooling. Changes in resistivity with time at a constant temperature are relaxation in nature. The relaxation time decreases with increasing temperature. A similar sintering picture is observed by measuring thermal expansion. During heating from 20-850°C, the specimen expands by 0.5-0.7 percent. Then, at 960°C, an extreme of 3 percent negative shrinkage is observed; this is followed by subsequent compacting. Sintering occurs most rapidly in the narrow interval from 960 to 1,010°C, where a maximum shrinkage of about 12 percent is observed. A second negative extreme is observed at 1,010-1,100°C, apparently resulting from peritectic melting of the specimen. The maximum superconducting temperature and minimum width of transition to superconductivity are observed in specimens annealed at 910-927°C. Figures 6, References 7: 2 Russian, 5 Western.

UDC 621.7.044.2:621.762.4

#### Properties of High-Temperature Superconducting Materials Obtained by Rapid Compaction

18410105n *Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian*  
No 5, Sep-Oct 88 pp 84-87

[Article by A. A. Deribas, E. V. Matizen, V. F. Nesterenko, S. A. Pershin, M. A. Starikov, A. N. Voronin, and A. G. Blinov, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences; Special Design Bureau of Hydropulse Technology, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] A study is made of the superconductivity characteristics of the system Y-Ba-Cu-O obtained by rapid compaction of powder containing a superconducting phase in the initial state and by rapid pressing of a mixture of the oxides  $Y_2O_3$ , CuO, and  $BaCO_3$ , taken in quantities corresponding to a 1:2:3 system, with subsequent heat treatment in air. Various compacting geometries were studied to produce rods, including rods in a metal shell and rods with a central metal rod or aperture. It was found that superconducting Y-Ba-Cu-O materials can be obtained from the initial oxides and  $BaCO_3$  by pulsed pressing with subsequent heat treatment in air. The initial superconducting phase is not significantly damaged by the compacting of high-temperature superconducting powders. Rapid compacting can produce monolithic specimens, including joints with metals in various geometries. Figures 3, references 15: 4 Russian, 11 Western.

UDC 537.312.62

#### Superconducting Quantum Interferometer Based on $YBa_2Cu_3O_{7-8}$ Operating at Liquid-Nitrogen Temperatures

18410105o *Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian*  
No 5, Sep-Oct 88 pp 87-92

[Article by A. G. Klimenko, A. G. Blinov, and E. V. Matizen, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] Results are presented from a study of the resistive and magnetic properties in weak fields of  $YBa_2(Cu_{1-x}Fe_x)_3O_{7-8}$  suitable for use as operating elements in high-temperature squids. The design is described, and parameters are presented of RF squids operating at 4.2-90 K. Specimens were obtained by ceramic technology by sintering mixtures of the initial components  $Y_2O_3$ ,  $BaCO_3$ , CuO, and  $Fe_2O_3$ . Resistive characteristics were tested on specimens measuring  $1 \times 1 \times 10 \text{ mm}^3$  at 4.2-300 K by a four-contact potentiometric method. Magnetic properties were measured in weak constant fields at 1.5-100 K. The results indicate the possibility of using random Josephson grids in ceramic high-temperature superconductors to create squids operating at temperatures above the boiling point of liquid nitrogen. Figures 4, References 14: 11 Russian, 3 Western.

UDC 538.945:681.3.06

#### Design Principles of High-Temperature Superconductivity Data Base

18410105p *Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian*  
No 5, Sep-Oct 88 pp 96-100

[Article by V. R. Belosludov, S. V. Borisov, P. I. Vadash, F. A. Kuznetsov, V. G. Martynets, N. K. Moroz, P. P. Samoylov, V. A. Titov, Ye. V. Kholopov, and L. I. Chernyavskiy, Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] Several thousand works on high-temperature superconductivity have been published since November of 1986. A data base is needed to provide specialists with information on methods of production, composition, properties, structure, and applications of these materials. A group of specialists has designed a data base for this purpose, the structure of which is presented in this article.

UDC 538.945

#### Structure and Content of Oxygen in $YBa_2Cu_3O_{7-8}$ High-Temperature Superconductor

18410105q *Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian*  
No 5, Sep-Oct 88 (manuscript received 3 Mar 87) pp 101-106

[Article by Yu. T. Pavlyukhin, A. I. Rykov, and N. G. Khaynovskiy, Institute of Solid-State Chemistry and Processing of Mineral Raw Materials, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] Results are presented from a study of the structure of  $YBa_2Cu_3O_{7-8}$  high-temperature superconductor as a function of its heat treatment. Specimens were synthesized from a mixture of yttrium and copper

oxides and barium nitrate, homogenized and ground to a particle size of about 1  $\mu\text{m}$ , pressed, and heated 6-12 hr in air at 900°C. Roentgenograms were taken in air at room temperature in  $\text{CoK}_\alpha$  radiation. The various heat treatment conditions generate perovskites with oxygen contents of 6.11-6.94. A content of 6.6-7.0 corresponds to the ortho phase, 6.4-6.6 to the ortho' phase, and 6.0-6.5 to the tetra phase. The tetra phase is metastable. Figure 4, references 20: 4 Russian, 16 Western.

UDC 538.945

**Stages in Thermally Induced Gas Exchange in  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$  High-Temperature Superconductor**  
18410105r Novosibirsk IZVESTIYA SIBIRSKOGO  
OTDELENIYA AKADEMII NAUK SSSR: SERIYA  
KHIMICHESKIKH NAUK in Russian  
No 5, Sep-Oct 88 (manuscript received  
3 Dec 87) pp 114-116

[Article by Yu. T. Pavlyukhin, N. G. Khaynovskiy, and  
A. I. Rykov, Institute of Solid-State Chemistry and  
Processing of Mineral Raw Materials, Siberian Division,  
USSR Academy of Sciences, Novosibirsk]

[Abstract] A study examined gas exchange at various temperatures so as to determine the characteristic stages of the process in a superconducting ceramic made from the oxides of yttrium and copper and barium nitrate. The initial components were ground to micron size, carefully homogenized, decomposed at 900°C for 30 minutes, carefully reground, pressed into tablets at 5  $\text{t/cm}^2$ , heated to 900°C in air for 5 hours, and then slowly cooled at 150°C/h, after which it yielded specimens containing only the orthorhombic phase. The specimens were then heated in oxygen at 4 atm at 750°C for 3 hours and cooled to room temperature at 150°C/h. The unit cell parameters were then determined, and thermogravimetric analysis was performed at various pressures from  $10^{-2}$  to 900 mm Hg. The results indicate the characteristic temperature areas of the exchange of the material with oxygen in the gas phase. The first (low-temperature) area corresponds to intercalation of neutral oxygen, which is apparently not accompanied by oxidation-reduction reactions. The second area corresponds to the exchange of structural oxygen with a change in the valent state of the copper and oxygen. Figure 1, references 6: 2 Russian, 4 Western.

UDC 547.79+547.856

**Cyclocondensation Involving N-Substituted Imidoyl Chlorides Containing Phosphonium Group**

18410103i Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11 Nov 88 (manuscript  
received 4 Jan 87) pp 2465-2471

[Article by O. B. Smoliy, V. S. Brovarets, V. V. Pirozhenko, and B. S. Drach, Institute of Organic Chemistry, Ukrainian Academy of Sciences, Kiev]

[Abstract] This study examines acylaminomethyl(triphenyl)phosphonium salts and their transformation to the corresponding phosphorylated imidoyl chlorides. Proof of the structure of the phosphonium salts is obtained by chemical methods. The phosphonium salts are found to be suitable for the Wittig reaction. The phosphorus-containing imidoyl chlorides are easily condensed with sodium azide and methyl anthranilate to produce new types of (heterylmethyl)phosphonium salts that can be used in the Wittig reaction. References 7: 3 Russian, 4 Western.

UDC 541.127+547.233.4

**Mechanism of Diphenylamine Arsenation by Arsenic Trichloride**

18410103n Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 23 Apr 87) pp 2493-2496

[Article by V. I. Gavrilov, L. M. Pilishkina, and R. R. Rakhmatullin, Kazan Institute of Chemical Technology imeni S. M. Kirov]

[Abstract] In order to determine the mechanism of the arsenation of diphenylamine, the authors studied the kinetics of its interaction with arsenic trichloride. To eliminate the influence of a possible reverse decomposition reaction of 10-chloro-5,10-dihydrophenarsazine by hydrogen chloride, only the initial segments of the kinetic curves were analyzed. The kinetic studies were performed in bromobenzene at 140°C. It is found that the interaction of arsenic trichloride with diphenylamine has first order kinetics with respect to  $AsCl_3$  and zero-order kinetics with respect to the diphenylamine. The arsenation kinetics are apparently determined by dissociation of arsenic trichloride on the chlorine anion and the dichloroarsenium cation. References 10: 7 Russian, 3 Western.



UDC 541.63:547.89

**Spatial Structure of Phosphorus-Containing Heterocycles. XLVI. Quantitative Description of Conformations and Raman Spectra of 2-Phenyl-2-Thiono-5,6-Benz-1,3,2-Dithiaphosphepine**

18410103a Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 5 Feb 87) pp 2412-2417

[Article by S. G. Gnevashev, R. P. Arshinova, I. Kh. Shakirov, R. R. Shagidullin, and B. A. Arbuzov, Kazan State University imeni V. I. Ulyanov-Lenin]

[Abstract] A quantitative approach was used to study possible conformations of the seven-membered 1,3,2-dithiaphosphepine ring with one planar fragment. A detailed analysis was performed on 2-phenyl-2-thiono-5,6-(4,5-dimethylbenz)-1,3,2-dithiaphosphepine (I), as well as on its oxide (II), for which x-ray structural studies were performed. Raman spectra were also studied for the sulfide of (I). It was found that in spite of the apparent simplicity of these seven-membered heterocycles they are potentially varied in the conformation aspect. Four conformations must be studied for the cyclical portion of the molecule. This number should be doubled due to the varying orientation of exocyclic substituents at the phosphorus atom. The question of the energy relationships of the conformers is not answered. According to the Raman spectrum, (I) has a chair confirmation in its crystalline form with an axial thiophosphoryl bond. A second conformer appears in solutions in polar solvents. Figure 1, references 17: 5 Russian, 12 Western.

UDC 541.63:547.89

**Spatial Structure of Phosphorus-Containing Heterocycles. XLVII. 2-Phenyl-5,6-Benz-1,3,2-Dithiaphosphepines: Synthesis and Conformation Behavior**

18410103b Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 7 Jan 87) pp 2417-2423

[Article by R. P. Arshinova, S. G. Gnevashev, R. A. Kadyrov, V. V. Klochkov, and B. A. Arbuzov, Chemical Scientific Research Institute imeni A. M. Butlerov; Kazan State University imeni V. I. Luyanov-Lenin]

[Abstract] The authors synthesized 5,6-benz-1,3,2-dithiaphosphepines by using 1,2-dimethyl-4,5-di(mercaptomethyl) benzene reacted with phenyl dichlorophosphine to produce a white powder mixture of phosphorus compounds. Fractional crystallization yielded three products: 2-phenyl-1,3,2-dithiaphosphepine, its sulfide, and its oxide. The conformation behavior of the sulfide and oxide was studied by dynamic PMR spectroscopy and the method of dipole moments. The oxide is found to be homogeneous with a chair conformation and axial P=O

bond. The sulfide consists of two forms in equilibrium, with the chain conformation with an axial thiophosphoryl group predominating to about 90 percent. The dipole moments of the compounds and polarities of the P=O and P=S bonds are determined. Figures 2, references 14: 6 Russian, 8 Western.

UDC 547.26'118

**Dialkyltrichloromethylphosphonites. Synthesis and Properties**

18410103f Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 9 Oct 86) pp 2441-2447

[Article by T. Kh. Gazizov, L. N. Uxmanova, and A. N. Pudovik, Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Affiliate, USSR Academy of Sciences]

[Abstract] Dialkyltrichloromethylphosphonites were produced by a simple method that does not require a large quantity of solvent, HCl acceptor, and filtering. Trichloromethyldichlorophosphine (I) was reacted with 2 mol of the corresponding alcohol at room temperature and 190 mm Hg to remove the HCl liberated from the reaction mixture. The reaction of I phosphine with alcohols at 1:1 under the same conditions forms the corresponding alkylchlorotrichloromethyl phosphonite. Trichloromethylphosphonous acid esters can be used as phosphorylating reagents. Diamyltrichloromethylphosphonite reacts with HCl to form amyltrichloromethylphosphonite, and in the presence of amyl alcohol, the P-C bond is broken, and diamylphosphite is formed. The reaction of diphenyltrichloromethylphosphonite with HCl in the presence of phenyl forms triphenylphosphite. Dimethyltrichloromethylphosphonite at 125°C or higher is isomerized to methyl(methyl)trichloromethylphosphinate. The reaction of dimethyltrichloromethylphosphonite with methyl iodide (forming methyl(methyl)trichloromethylphosphinate) and with chloral (forming methyl-β-β-dichlorovinyltrichloromethylphosphonate) occurs upon heating to 100°C. Figure 1, references 15: 12 Russian, 3 Western.

UDC 547.26'118+547.539.151

**Reaction of N-Chloroketimines With Trivalent Phosphorus Derivatives**

18410103g Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 7 Jan 87) pp 2447-2456

[Article by L. N. Markovskiy, Yu. G. Shermolovich, V. Yu. Abramov, V. S. Talanov, and V. I. Staninets, Institute of Organic Chemistry, Ukrainian Academy of Sciences, Kiev]

[Abstract] This study examines the reaction of N-chloroketimines with trivalent phosphorus derivatives. N-chloroketimines are reacted with phosphorus trichloride

under various conditions. The structure of the reaction products is found to depend on the nature of the substituents at the carbon atom of the azomethine fragment and at the phosphorus atom. For triphenylphosphine, phosphonium salts are formed; for medium phosphites and  $\text{PCl}_3$ , N- $\alpha$ -chloroalkylphosphazo compounds or phosphoranes are formed. Tables 2.

UDC 547.241+547.66

**Element-Containing Norbornenes and Their Derivatives. II. Reaction of Cyclopentadiene With Isobutyl- and 2,3-Dihydrofuryl-4-Phosphonic Acid Derivatives**

18410103h Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript received 16 Feb 87) pp 2462-2465

[Article by A. A. Krolevets, A. G. Popov, and A. V. Adamov]

[Abstract] The reaction of cyclopentadiene with diesters and halogen anhydrides of isobutenyl- and 2,3-dihydrofuryl-4-phosphonic acids is studied. Regardless of the nature of the substituent at the phosphorus atom, isobutenylphosphonic acid derivatives react easily with cyclopentadiene in a ratio of 1:1.5 in solution in ethyl alcohol at  $-78-25^\circ\text{C}$  to form the corresponding products of [2+4]-cycloaddition. Treatment of a complex of  $\text{PCl}_5$  with tetrahydrofuran with hydrogen sulfide produces 2,3-dihydrofuryl-4-thiophosphonic acid dichloride with a good yield. The use of dimethyldichlorosilane as the solvent in the reaction of  $\text{PCl}_5$  with tetrahydrofuran decreases the consumption of  $\text{PCl}_5$  without decreasing the yield of the dichloride. References 4: Russian.

UDC 547.241

**Synthesis of Tertiary Phosphines and Phosphine Oxides by Nucleophilic Attachment Using Interphase Catalysts or Superbasic Media**

18410103j Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript received 27 Aug 86) pp 2472-2478

[Article by R. A. Khachatryan, S. V. Sayadyan, N. Yu. Grigoryan, and M. G. Indzhsikyan, Institute of Organic Chemistry, Armenian Academy of Sciences, Yerevan]

[Abstract] A detailed study is presented of the reaction of secondary phosphines with 1,3-butadiene and isoprene as well as the synthesis of tertiary phosphines and phosphine oxides based on styrene, chlorine-containing dienes, or acetylene compounds under conditions of interphase catalysts or in a superbasic medium. In a continuation of previous studies, diphenyl- and methylphenylphosphines are used to establish that the reactions with 1,3-butadiene and isoprene can be performed even more successfully in the presence of catalytic quantities of alkali both under interphase catalysis conditions

using tetrabutylammoniumbromide and in a superbasic medium (dimethylsulfoxide, caustic soda). The reactions form tertiary phosphines and phosphine oxides with good yields. The reaction of secondary phosphines and diphenylphosphinous acid with chlorine-containing dienes leads to the formation of diphosphorus-containing compounds with butene-2-ylene and butene-2-ylene groups, respectively. References 8: 5 Russian, 3 Western.

UDC 541.67+541.49

**Complexes of 1,3,5- $2\lambda^5$ -Triazaphosphines With  $\text{SbCl}_5$  in Benzene**

18410103k Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript received 11 May 87) pp 2479-2482

[Article by N. A. Ivanova, D. Ya. Movshovich, S. B. Bulgarevich, P. P. Kornuta, N. V. Kolotilo, L. Ye. Rybalkina, and V. A. Kogan, Scientific Research Institute of Physical and Organic Chemistry, Rostov State University imeni M. A. Suslov; Institute of Organic Chemistry, Ukrainian Academy of Sciences, Kiev]

[Abstract] This study examines the reaction of a number of substituted 1,3,5- $2\lambda^5$ -triazaphosphines with  $\text{SbCl}_5$ , Lewis acid to determine which potential coordination center is primarily involved in complex formation. The method of dipole moments was used under isomolar series concentration conditions since it is quite sensitive to the formation of even strongly dissociated molecular complexes. A vector additive system was used to calculate the moments of interaction for all coordination versions in order to determine which nitrogen atom is involved in complex formation. It was found that molecular donor-acceptor-type complexes with 1:1 compositions were formed. The  $\text{SbCl}_5$  coordination occurs at atom  $\text{N}^5$ . Figures 2, references 11: Russian.

UDC 547.26'118:541.63

**Photoelectron Spectra and Electron Structure of Organophosphorus Compounds. VIII. Theoretical Analysis of Spatial Structure of 2-X-1,3,2-Dioxaphospholines**

18410103l Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript received 6 Apr 87) pp 2482-2489

[Article by Z. G. Bazhanova and V. V. Zverev, Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Affiliate, USSR Academy of Sciences]

[Abstract] A study is presented of the factors influencing preference of a given spatial structure of 2-chloro-1,3,2-dioxaphospholan (I), 2-methoxy-1,3,2-dioxaphospholan (II), and 2-dimethylamino-1,3,2-dioxaphospholan (III) by orbital modeling and division of the total energy into its components. The results of the orbital analysis agree

with the change in total energy of the phospholan conformations studied. It is found that the a-conformation is preferred for 2-chloro-1,3,2-dioxaphospholan, the e-conformation is preferred for 2-dimethylamino-1,3,2-dioxaphospholan, while 2-methoxy-1,3,2-dioxaphospholan has a complex conformation composition. The result of the explanation of the preference of a given conformation of these molecules depends on the basis. Preference in the sp-basis is determined by the ratio of direct charge transfer to the exocyclic substituent and reverse shift from it, while in the spd-basis the degree of population of  $d_{\pi}^*$  orbitals of the phosphorus atom is also involved. Analysis of intramolecular interactions based on orbital models agrees with subdivision of the total energy into one- and two-center components. Figure 1, references 11: 5 Russian, 4 Western.

UDC 547.241

**Some Peculiarities of Formation of Carboxylic Acid Adducts With Phosphorous Acid Esters**

18410103m Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 58 No 11, Nov 88 (manuscript  
received 28 May 87) pp 2490-2493

[Article by V. I. Krutikov, S. F. Aleynikov, Ye. A. Kalaverdova, and A. N. Lavrentev, Leningrad Technological Institute imeni Lensovet]

[Abstract] Characteristic features are noted of the reaction of phosphites with carboxylic acids, and an attempt is made to explain data obtained in a study of the interaction of various carboxylic acids and their anhydrides with phosphorus acid esters. For this purpose, the reactions of dimethyl phosphite with pyruvic and acetic acids and of trialkylphosphites with heptafluorobutyric acid were studied by UV, NMR, and IR spectroscopy. It is found that the reaction of dimethylphosphite with pyruvic acid forms hydrogen bonds between the hydroxyl of the acid and the phosphoryl oxygen of the phosphite molecule. The mechanism of this reaction differs from the reaction of phosphites with strong carboxylic acids. The reactions of polyhalogen carboxylic acid with phosphorous acid esters have an identical nature, which is confirmed by the excellent  $-\Delta H-\Delta S$  correlation. Figures 3, references 9: Russian.

### Supertankers Plagued by Faulty Equipment Design

18410132a Moscow SOTSIALISTICHESKAYA  
INDUSTRIYA in Russian 29 Dec 88 p 2

[Article by engineer I. Orekhov, former chief, Crimean Inspection Office of the USSR Register: "Tested by Sea and Land: On the Fate of Soviet Supertankers"]

[Text] Some time ago, the designers of Soviet supertankers asserted that the vessels going out to sea were the latest word in ship engineering—by far better than foreign analogues! A bold assertion, I must say, since only one steam generator is installed in each of these steam-turbine ships. And yet the regulations of the USSR Register proclaim: "As a rule the number of main boilers in vessels certified for unrestricted navigation must be not less than two." An attempt might have been made to justify this violation of the Register by pointing to the ultrahigh dependability of our boilers. But alas!

For example the boiler aboard the lead steam-turbine ship the "Krym" failed back during delivery trials at the building dock. In this case it started a fire in the machine and boiler room. The boiler was restored with enormous difficulty, and despite the protests of the command, "the successful introduction of domestic supertankers" was reported, after which the vessel was shoved out to sea.

But the sea is unforgiving of bad work. Soon after leaving Novorossiysk vibrations loosened the boiler, its fasteners broke, and the foundation supports were deformed. Other flaws surfaced as well. Maneuvering with difficulty, the captain was nonetheless able to pilot the vessel at low speed to Le Havre, where he put it up for repairs.

A rather typical story, as typical as the impunity of the builders. As a result one more fire occurred in the same machine and boiler room of the "Krym," this time a devastating one.

As usual, when the first misfortunes occurred aboard the "Krym," the law enforcement organs initially suspected the seamen to be at fault. But when they became persuaded of the reverse, they would not even lift a finger to protect state interests and thus keep poor-quality equipment out of the fleet. The bureaucracy, incidentally, perceived this to be an indulging attitude toward itself, and so it immediately installed the same kind of boilers aboard the supertankers "Kuban," "Kavkaz," "Kuzbass," and others—and once again just a single boiler.

From time to time all of these boilers break down, and in order to lessen the consequences, the Novorossiysk Marine Steamship Company halved the steam pressure norm of these boilers. Understandably the seagoing qualities of the supertankers worsened dramatically. And even so, they spend more time undergoing repair than at sea.

But the problem is not limited to just these misfortunes with the supertankers. The propeller shafts of all seven new "Pekin" class tankers delivered to the Novorossiysk Marine Steamship Company broke right away. Usually, such basic parts last longer than the ships themselves, and after the latter are scrapped, they are used as blanks or spare parts for other ships. Everyone knows that it is fundamentally impossible for a new shaft to break "due to a captain's carelessness." Only a design error can be responsible for its "destruction." Nonetheless it was the seamen who sail these "powder kegs" that were the sole target of Themis's arrows.

A design error involving a bracket securing a 50-kilogram magnesium tank protective cover was made on "Kazbek" class vessels. The result was the tragedy of a tanker of that class, the "Yegoryevsk." After setting out to sea from Hamburg, where it had delivered its cargo, a protective cover caused a spark as it fell, and the explosion demolished the cargo tanks and pump room. The vessel was almost completely destroyed.

The merchant marine does not have a single steam generator left that has not suffered some kind of problem owing to design shortcomings: flames shooting out of fire boxes, gas ducts catching fire and exploding, pipes rupturing, and other mishaps. And unless they result in people's death, they are all carefully covered up. Invariably, you see, publicity would adversely affect the well-being of primarily the seamen, who became persuaded long ago that even in accidents that were clearly the result of technical causes the shore commissions usually blame the ship's crew.

Law enforcement organs go along with the conclusions of these commissions, and this incidentally generates another evil. The secrecy surrounding ship accidents creates the appearance that the design concepts are faultless. Laudatory reports from the crews and embellished accounts from the steamship companies create the illusion that the ship builders are conscientious. This is precisely why those accidents occurred, with loss of human life, aboard the tanker "Kamensk-Uralskiy" in 1960, the supply ship "Severnnyy Polyus" in 1984, and the steamship "Vasilii Shelgunov" in 1987.

I can see only one solution to this problem—decisively barring unfit vessels from the sea. Otherwise we might be compelled to apply the "wisdom" of the USSR Ministry of Maritime Fleet, which it had demonstrated in 1985 with the tanker "Krym." When the tanker's main boiler failed irreparably, the tanker was awarded the highest score for its technical condition. After this, the steam-turbine ship was solemnly transferred to the USSR Ministry of Gas Industry, where it is now being used for oil storage. The Hermitage could be used with the same success as a vegetable storehouse. The state was obviously deceived, to the tune of 65 million rubles. Such things are possible when bureaucratic mutual benefit is allowed to exist unchecked.

Nonetheless I would like to finish on an optimistic note. Restructuring is proceeding, and there is a real possibility not only for preventing such outrages but also for attempting to recover the lost profits by refitting or modernizing the vessels.

The advantage of modernization is that it preserves formerly materialized labor and invested capital. The consumer qualities of an object are quickly restored at relatively low cost. Other countries have already developed the methods of modernizing obsolete vessels to carry new cargo and perform new functions. But in our case the purpose of such modernization would be to correct design shortcomings.

As soon as we recognize this, we could not only effectively return the "Krym" to operation but also fully rehabilitate the entire series of supertankers of the same class. As we know, their main steam propulsion plant costs less than 5 percent of the cost of the vessel itself. By purchasing just one less tanker abroad, we could save enough money to acquire dependable steam generators that could be easily installed in place of the boilers on all supertankers. Thus instead of one average imported tanker we would receive six top-class giant bulk cargo carriers.

Moreover rehabilitation of the supertankers will return the country a minimum of 250 million out of the 340 million rubles invested into their construction. The sole obstacle to implementing this proposal is the ambition of the Central Scientific Research Institute of the Maritime Fleet and the Mortehtsudoremprom [not further identified], which refused to recognize the widely known shortcomings of the boilers. This is the test on land. Not of the boilers, but of the truth!

**Trucks Modified to Run on Gas-Gasoline Mixture**  
*18410132e Moscow SOTSIALISTICHESKAYA*  
*INDUSTRIYA in Russian 18 Jan 89 p 1*

[Article by TASS correspondent D. Kiyanskiy: "On Hybrid Fuel"]

[Text] Fifty unusual motor vehicles have appeared on the streets of Kiev—they run on a gas-gasoline mixture.

One of the principal requirements imposed on gasoline is its antiknock property, which is expressed by its octane number. Most of our gasoline is ethylated in order to increase it. But a high price must be paid for higher quality fuel: Toxic combustion products accumulate in the biosphere. This is why specialists do not advise eating berries or, let us say, apples growing near a busy highway. The use of ethylated gasoline is prohibited in resort zones and in a number of large cities. A decision was made to halt the production of such fuel beginning in the 1990s. But what is it to be replaced by?

Compressed gas is a possibility: Its combustion products contain many fewer toxic substances. But modification of the engine means a 20 percent power loss. The cumbersome and heavy fuel containers are another shortcoming: A tank weighing 93 kilograms accommodates only 10 cubic meters of gas, which is equivalent to 10 liters of gasoline. And if eight tanks were to be strapped to a motor vehicle, 700 kilograms of payload would be lost. As a result operating each such am vehicle is much more expensive than a conventional one.

Scientists of the Ukrainian SSR Academy of Sciences Gas Institute proposed using natural gas as an additive that increases gasoline's octane number. A series-produced fuel system from a conventional compressed gas motor vehicle was adapted for this purpose—minor modifications were made of the gas regulator and carburetor. Moreover the engine of such a vehicle can also run quite well on gasoline—the driver need only flip a switch in the cabin.

What are the advantages of a gasoline-gas "menu"? Economization of scarce fuel is the main one: Gas replaces from 20 to 40 percent of the low-octane gasoline. Motor vehicles running on mixed fuel are ecologically cleaner—there are no lead compounds in exhausts, and there are many fewer carbon monoxides and nitric oxides. The payload is higher in comparison with a compressed gas vehicle, and the range on one refueling is greater in comparison with a gasoline vehicle.

Scientists of the Gas Institute designed a fuel feed system jointly with associates from the Kiev polytechnical and motor highway institutes and the GosavtotransNIIproyekt for the most common trucks—GAZ-52, GAZ-53, and ZIL-138.

The transition to a gasoline-gas mixture is especially important to those regions where refineries make surpluses of low-octane gasoline, as for example in the Ukraine. Low-octane gasoline fractions of gas-condensate deposits can also be used successfully in West Siberia.

Specialists feel that some passenger cars can also be converted to the gasoline-gas mixture. This would require organizing production of special gas apparatus and small tanks.

**Coal Gasification Contest Announced**  
*18410132f Moscow SOTSIALISTICHESKAYA*  
*INDUSTRIYA in Russian 29 Jan 89 p 1*

[Article: "Gas from Coal"]

[Text] The USSR State Committee for Science and Technology and the board of the USSR Union of Scientific and Engineering Societies have announced a contest

to develop the concepts (technology) for creating an ecologically clean enterprise producing new types of fuel through subterranean coal gasification.

The goal of the contest is to select the most effective procedures for producing new forms of fuel through subterranean gasification of coal (using its unaccounted-for and low-grade coal reserves, completely spent mining enterprises, and individual mine sections) that would make it possible to introduce additional fuel and energy resources into production (especially) in the country's remote regions and to make effective and sensible use of these resources while significantly improving the ecological circumstances of their use.

The contest is open to the collectives of associations, enterprises, and institutes (irrespective of their departmental subordination); all creative collectives; and individual specialists and citizens of the CEMA countries.

The following prizes have been established for the winners of the contest and for participants taking prize-winning places:

a first prize of 10,000 rubles;

five incentive prizes of 1,000 rubles each.

Contest materials labeled "Contest—Subterranean Coal Gasification" should be sent to the USSR State Committee for Science and Technology prior to 10 April 1989 at the following address: 103905, Moscow, Gorkiy Street, 11.

Information on the status of the contest may be obtained from the USSR State Committee for Science and Technology. For information, call 229-23-55.

UDC 552.57:539.26:622.872(477.6/62)(574.31)(470.5)

#### **Comparative Study of Structural Features of Donetsk, Kuznetsk, and Karaganda Basin Coal Using X-ray Analysis**

18410092a Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 3 Sep 86) pp 18-23

[Article by M. A. Frolov and L. A. Reznik, Novocherkassk Polytechnical University]

[Abstract] Thirteen coal samples from various mines and layers in the Donetsk Basin, 16 samples from the Kuznetsk Basin, and 10 from the Karaganda Basin were studied by x-ray analysis. The fused 002 and  $\gamma$ -band peaks were separated mathematically by using background subtraction and symmetry assumptions. Analysis of the interplanar distance values obtained indicates that this parameter decreases during coal formation. Donetsk coal had lower interplanar distances and higher areas of coherent dispersion and interlattice ordering values,

indicating earlier and more intense ordering and compaction. The packing and ordering processes during coal metamorphosis were found to be different for the three basins. For Donetsk low-metamorphosis coal, the  $\gamma$ -band was fixed at a carbon content of 79.8 percent, while for Kuznetskiy coal it was noted at carbon contents of 83.8 percent or more. As the degree of metamorphosis increased, the interplanar distance decreased and the ordering increased. Analysis of the data indicated that in the Donetsk basin condensation of carbonaceous layers was more intense during the lower and intermediate stages of metamorphosis. The process began later in the Kuznetsk Basin. Significant structural differences between metamorphosis stages were not found in Karaganda coal. The differences noted are responsible for the variability in dust formation and chemical activity of fresh dust seen. Figures 2; references 4 (Russian).

UDC 543.53 546.62

#### **Multielement Gamma Activation Analysis of Coal**

18410092b Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 29 Jun 87) pp 29-35

[Article by N. Sodnom, Sh. Gerbish, V. Ye. Zhuchko, O. D. Maslov, Kh. Khpistov, and A. Fiderkevich, United Institute of Nuclear Studies]

[Abstract] A method for the multielement gamma activation analysis of coal is described. The method uses the bremsstrahlung of an electron cyclotron. Samples and standards were irradiated for 4-5 hours with a maximum electron acceleration energy of 18 MeV. Spectra were measured with Ge(Li) or high purity Ge detectors. Repetitive measurements on two spectrometers with different cooling times made it possible to determine 36 elements with an accuracy of 5-15 percent. The exposure times ranged from 30 minutes to more than 20 days; the measurement times ranged from 5 to 60 minutes. The calculated detection limits ranged from 0.1 g/ton for Th and U to 300 g/ton for K. Self-absorption was determined experimentally by using a thin  $^{226}\text{Ra}$  source. The method was used to determine the concentration of 36 elements in 17 samples of Mongolian coal and 16 samples of Polish coal. By using a 4-5 hour gamma radiation exposure, it should be possible to determine 40-50 elements and to lower detection limits for Re, Ta, Tl, Cs, Au, Th, U, Mo, Nb, Zr, and As to  $1 \times 10^{-6}$  to  $1 \times 10^{-7}$  g/g. Figures 3; references 10: 7 Russian, 3 Western.

UDC 550.835

#### **Method for Increasing Accuracy of Instrumental Nuclear Physics Analysis of Coals of Varying Coarseness**

18410092c Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 19 Nov 87) pp 36-40

[Article by Yu. N. Pak and A. V. Vbovkin, Karaganda Polytechnical Institute]

[Abstract] Rotation of the sample cuvette around the detector has been used to reduce errors caused by particle size nonhomogeneity in the  $\gamma$ -ray dispersion analysis

of coal. It is proposed that this error could be further reduced by using a back-and-forth movement of the detector as well. Equations were derived for the linear velocity of the detector and the angular velocity of the sample cuvette to permit a spot in the sample plane to move in an Archimedes spiral. The validity of the model was tested on a laboratory sample of 4 kg by using a period of 240 seconds. The reproducibility of results obtained when using static and dynamic detectors was compared by using an experimental plan allowing equal degrees of freedom. Comparisons were conducted on samples with ash contents from 12.6 to 28.7 with a particle size of 1 mm or 3-10 mm. In all cases the dynamic detector gave coefficients of variation that were more than two- to threefold less. The mean coefficient of variation was 0.48 percent after 34 samples were analyzed. Figures 3; references 9 (Russian).

UDC 622.02:541.18

**Effect of Porosity and Specific Surface Area on Wettability of Coal**

18410092d Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 2 Dec 87) pp 46-48

[Article by V. P. Berveno, V. D. Samchenko, and N. M. Nedosekina, Institute of Coal, Siberian Department, USSR Academy of Sciences]

[Abstract] According to previously published data, coal wettability increases with porosity. The cosine of the wetting contact angle is approximately linearly proportional to the porosity, indicating that the contact angle for the actual surface is approximately constant. The dependence of the heat of wetting on the coal's internal surface was examined in order to verify the proposal that the energy of the reaction between a liquid and solid surface is constant for coals of differing degrees of coalification. The heat of wetting of coal with a particle size less than 0.2 mm, using mono- and dialkylesters of polyethylene glycol, was determined in a calorimeter. The dependence of the heat of wetting on the change in surface angle was found to be linear for coals of every technological class as well as for anthracite. This indicates that differences in wettability between coals are determined by porosity and specific surface area of pore walls, not by molecular composition. Figures 3; references 6 (Russian).

UDC 669.046.462 662.62

**Effect of Anthracite Oxidation State on Reduction of Metal Oxides**

18410092e Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 14 Nov 87) pp 72-77

[Article by V. I. Saranchuk, L. Ya. Galushko, and V. A. Khazipov, Institute of Physical Organic Chemistry and Coal Chemistry, UkSSR Academy of Sciences]

[Abstract] A study examined the changes in the reactivity of anthracite during its open storage and the influence of storage time on the reduction of iron and nickel

oxides. During the 3 three months of storage, which began in January, the oxidation state decreased slightly, the mean particle diameter decreased, and the specific surface area increased. Over the next 9 months, the oxidation state, surface area, and heat of methanol wetting increased steadily. The dynamics of oxygen accumulation indicated that the maximum rate for this process occurred in spring and summer. This is due to hindered oxygen diffusion caused by carbon-oxygen complexes. Curves for changes in reactivity and desiccator oxidation had the same form as the curve for oxygen accumulation. The degree of reduction of nickel or iron oxides was linearly related to anthracite reactivity. The presence of adsorbed water in the anthracite decreased the reduction of nickel and iron oxides. Figures 5; references 9: 8 Russian, 1 Western.

UDC 678.01:521.378.325

**Effect of Pulsed Laser Radiation on Electrical Resistance of Anthracite Surface Layers**

18410092f Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 30 Nov 87) pp 82-84

[Article by A. B. Pavlinov, T. L. Trayduk, L. V. Vannikov, and V. Ya. Posylnyy, Institute of Electrochemistry, USSR Academy of Sciences, Shakhhtinskiy Section, Novochoerkassk Polytechnical Institute]

[Abstract] The effect of pulsed laser radiation on the resistance of thin layers of anthracite with varying degrees of metamorphosis was studied. Laser pulses with durations of 20 nsec and an energy of about 0.1 J/cm<sup>2</sup> at a wavelength of 530 nm were used. The first several pulses substantially reduced the resistance of the high initial resistance samples, which then stabilized. Measurement of postirradiation surface processes indicated that the change was irreversible. Low initial resistance samples showed only very small changes. The lowered resistance of weak metamorphosis samples is caused by a combination of laser effects leading to destruction of the surface layer of the anthracite via depolymerization and the formation of free radicals. The structures formed after laser radiation changed over time, as indicated by the increase in resistance observed after storage of the irradiated samples in air. Figures 3; references 4 (Russian).

UDC 662.743

**Thermal Dissolution of Fan-Yagnobskiy Coal**

18410092g Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 29 Jun 88) pp 96-102

[Article by A. B. Vol-Epshteyn, I. A. Plotnikova, V. V. Platonov, O. A. Klyavina, M. B. Shpilberg, Z. A. Rumyantseva, Z. I. Pevzner, and V. D. Okyshko, Tul'skiy Pedagogical Institute, Institute of Chemistry, TaSSR Academy of Sciences]

[Abstract] The thermal dissolution of Fan-Yagnobskiy coal mixed with Baltic combustible shale was studied. Thermal dissolution was conducted in an autoclave at

425°C and 7 MPa for 60 minutes and a coal:kerogen-70:tetralin:aniline:D4 ratio of 233:23.3:470:7:1. The liquid products, which constituted 56.1 percent of the total mass, were fractionated by atmospheric distillation into fractions boiling below 200°C (benzene fraction), at 230-360°C (diesel fraction), and above 360°C. The products were analyzed by cryoscopy, elemental and functional group analysis, IR, UV, and capillary GC. The benzene fraction represented 11.9 mass percent, the diesel fraction 6.2 mass percent, and the remainder with points above 360°C, 38.0 mass percent. The liquid thermal dissolution products were characterized by a high level of aromatic compounds with alkyl substituents and heterogeneous functional groups. The aromatic compounds of the benzene fraction included monocyclic benzene derivatives, while those of the diesel fraction were derivatives of phenanthrene, anthracene, and naphthalene, as well as tetracyclic condensed structures and hydroaromatics. The fractions with boiling points above 360°C contained bi-, tri-, tetra-, and pentacyclic aromatics and hydroaromatics. Asphaltene was 49.3 mass percent of this fraction. Figures 2; references 6: 5 Russian, 1 Western.

UDC 541.15,662.7

**Thermal Radiation Conversion of Coal Using Powerful Electron Beam**  
**18410092h Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 29 Dec 87) pp 103-107**

[Article by A. N. Ermakov, B. M. Zhitomirskiy, V. N. Popov, and B. G. Dzantiyev, Institute of Energetic Problems in Chemical Physics, USSR Academy of Sciences]

[Abstract] A study examined the thermal radiation gasification of coal by using a 5-kW electron accelerator, an electron energy of 8 MeV, and a beam diameter of about 5 cm. The experiments were conducted under continuous-flow conditions by using a flow of water vapor over the irradiated coal (except in the pyrolysis experiments). Nitrogen carrier gas was employed, and the composition of gas produced was determined by GC. Pyrolysis of 1-3-mm coal particles at 1.3 to 1.8 kW yielded about 50 percent hydrogen and 30 percent carbon monoxide. The maximum rate of gas evolution was observed 4 minutes after the start of irradiation at 1.8 kW. About 0.2 mm<sup>3</sup> of gas was produced for 0.4 kg of coal. At 1.3 kW, both the amount and rate of gas evolution were less than at 1.8 kW, which was due to the lower temperature achieved. The composition of the waste gases in the thermoradiation pyrolysis was approximately 5H<sub>2</sub>:3CO:1CO<sub>2</sub>:1CH<sub>4</sub>. When water vapor was used in gasification, the hydrogen and carbon monoxide evolution rates achieved steady states at electron beam powers similar to those used for pyrolysis. At 3-5 kW/L, the gas formed was 80-90 percent hydrogen and carbon monoxide. Energy usage decreased with increasing power, reaching 2.2 kW hr/m<sup>3</sup> hydrogen. This represents an energy conversion level of about 80

percent. A threshold in the dependence of reaction rate on power was seen, which is connected with the high activation energy barrier. The optimal power was about 1.5 kW and the optimal water vapor addition rate about 2 kg/hr. Coal particle sizes from 0.2 mm to 3 mm had no effect on reaction effectiveness. Figures 4; references 10: 9 Russian, 1 Western.

UDC 662.667

**Effect of Thermal Treatment of Anthracite on Properties of Pitch- Anthracite Composites and Articles**

**18410092i Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 6, Nov-Dec 88 (manuscript received 19 Oct 87) pp 121-127**

[Article by Ye. P. Tretakova, F. G. Zhiyangulova, V. P. Balykin, L. V. Garbaneva, V. A. Shaposhnikova, and G. B. Skripchenko, State Electronics Industry Scientific Research, Planning, and Design Institute]

[Abstract] In order to choose the optimal binder content and mixing scheme, experiments were conducted on binder interlayer formation in composites containing anthracite that had been subjected to varying degrees of thermal treatment. Highly metamorphosized anthracite containing 42 percent fusinite was used as filler. The limiting angle of wetting for pitch fusion, the temperature achieved, the filler's retentive capacity, the heat of wetting, and the tendency to cake were all measured. The properties of coal- pitch composites and pressed articles were found to be determined by surface properties and filler structure. Thermoanthracite, obtained at 1,300°C, had an active influence on binder interlayer formation, with the most stable layers involving binders that were enriched in components with a high degree of aromaticity. Graphitized anthracite had less effect on interlayer formation since the aliphatic components were preferentially adsorbed. The composition and structure of binder interlayers was mostly determined by the temperature and duration of component mixing. Using graphitized anthracite as the filler required increases in the duration or temperature of mixing to obtain optimal properties in pressed articles. Figures 1; references 9: 8 Russian, 1 Western.

UDC 662.442.66.011

**Combined Brown Coal Liquefaction Process**  
**18410100a Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 89 pp 4-7**

[Article by V. V. Aliulin, Ye. Ya. Plopskiy, A. L. Sobolevskiy, and V. M. Kirilets, Quebechev Motor Vehicle-Tractor Electrical Equipment and Carburetor Scientific Research Institute of Coal, Institute of Fossil Fuels]

[Abstract] The purpose of this work was the liquefaction of brown coal under conditions of thermal dissolution with subsequent treatment of the reaction mixture by



lower aliphatic alcohols in a supercritical dissolution mode to increase the yield of liquid products with a high hydrogen content and facilitate separation of the solid residue. The results indicate that the yield of liquid products is 1.5 times lower than is the yield of thermal dissolution extract. However, the quality of the products of supercritical dissolution is better in that they are richer in hydrogen. The results of the combined process of thermal dissolution for 30 minutes at 10 MPa and subsequent supercritical dissolution at 410°C and a pressure of 10 MPa in various alcohols indicate that the yield of liquid products is higher in all the experiments than for supercritical dissolution using the same solvents. The yield of extract is also somewhat higher than for dissolution alone. Liquefaction of the brown coal in the combined process thus combines the advantages of each of the two methods and produces liquid products with good yield that are identical in quality characteristics to supercritical dissolution products. The combined process significantly reduces the total consumption of lower aliphatic alcohols. References 8: Russian.

UDC 665.753.2

**Combined Purification of TS-1 Fuel at Oil Refineries To Remove Mechanical Impurities and Water**

18410100d Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 89 p 17*

[Article by V. B. Bobrovitskiy, V. G. Miroshnichenko, Yu. A. Usanov, and Yu. A. Golubev]

[Abstract] Type TS-1 fuel is purified of mechanical impurities and water by sedimentation in reservoirs, a process that may take 3 days. To accelerate sedimentation, reservoirs are heated, the sediment is collected in special heated receivers, and the lower layers of the water-containing fuel are transferred to settling reservoirs. These changes have decreased the time required to bring the field to the standard to 1 day. However, this increases fuel loss. A new TS-1 fuel purification complex has now been developed. It consists of type FOSN-400M filters to remove mechanical impurities down to the 20-25  $\mu$ m level and type FVO-125 water separator filters to remove emulsified water. This reduces the process to 2-3 hours and the frequency of cleaning of fuel storage reservoirs to once per year, reduces fuel loss, and achieves a total savings of 50,000 rubles per year. Figure 1, references 2: Russian.

UDC 665.63.733:621.315.615.2

**Production of Transformer Oil From Baku Low-Paraffin Petroleum**

18410100c Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 89 pp 12-13*

[Article by R. A. Agayeva, R. Sh. Kuliyeu, F. A. Kuliyeu, and F. R. Shirinov, Institute of Petrochemical Production imeni Yu. G. Mamedaliyev, AzSSR Academy of Sciences]

[Abstract] A technology has been developed for the production of transformer oil from Neftyanyye Kamni

deposit petroleum and its mixtures with the high-paraffin petroleum of Azerbaijan by processes of selective purification, deep paraffinization of the refined product by carbamide solution in isopropyl alcohol, and subsequent catalytic refining. The oil produced meets the requirements stipulated in GOST 982-80 for high-quality T-1500 transformer oil. Oil produced by selective phenol purification, deparaffination with carbamide solution in isopropyl alcohol, hydropurification, and contact catalytic purification meets the standards for type PT transformer oil, which must be twice as stable as T-1500 oil against oxidation at 145°C. References 2: 1 Russian, 1 Western.

UDC 621.892.097.804.12:543.422:541.123.81

**Influence of Vibration on Content of Deicing Fluid in Jet Fuel**

18410100e Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 89 pp 21-22*

[Article by B. G. Bedrik, V. N. Golbushkin, and N. M. Likhterova]

[Abstract] The influence of vibration on fuel in an aircraft fuel tank containing a deicing fluid to prevent crystallization of water was studied by using vibrations with a frequency of 80-200 Hz and an amplitude of 0.2 mm, which is characteristic of the vibrations actually measured in flight. Experiments were also performed on the storage of jet fuel with deicing fluid in glass containers under laboratory conditions with and without water at the bottom of the containers. The results indicate that deicing fluid should be added to jet fuel immediately before the aircraft tank is filled, fuel should not be stored under conditions allowing the accumulation of water, fuel quality should be monitored, and liquid-phase water should be removed from aircraft fuel tanks quickly. Figures 2, references 4: Russian.

UDC 62.665.754.038

**Influence of Heavy Fractions on Low-Temperature Properties of Diesel Fuels**

18410100f Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 1, Jan 89 pp 22-23*

[Article by B. P. Tumanyan, S. I. Kolesnikov, D. D. Yelagin, and A. A. Gureyev, Moscow Institute of Petroleum and Gas imeni I. M. Gubkin]

[Abstract] Natural petroleum surfactants can be used to depress crystallization in diesel fuel. This article studies the influence of various residual petroleum products and additives based on them on the low-temperature properties of diesel fuel components. Depressor additives were introduced at 0.1-0.5 percent by mass at room temperature. Types DPK-10 (native fraction) and DPK-102 (a product produced by heat treatment) were found to be most effective at concentrations up to 0.3 percent

by mass in diesel fuel. Both products decreased the pour point by 16°C. At higher concentrations, DPK-1 decreased the pour point to -38°C. Figures 2, references 7: Russian.

UDC 665.661[574.12]

**Karazhanbas Deposit Petroleum**

18410100g Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 1, Jan 89 pp 28-29*

[Article by V. A. Dorogochinskaya, E. D. Shulzhenko, V. P. Varshaver, R. K. Khabibulina, and L. R. Kochuleva, Grozinsk Scientific Research Institute]

[Abstract] The Karazhanbas petroleum deposit (Kazakh SSR) was discovered in 1974. This article presents results of studies of a standard-grade specimen of this petroleum according to unified test program No. 1. The physical and chemical properties of the specimen are as follows: density at 20°C, 931.6 kg/m<sup>3</sup>; viscosity at 50°C, 97.5 mm<sup>2</sup>/s; pour point, -18°C, flash point, -62°C. Its content (in mass percent) is as follows: silica gel resin, 15.9; asphaltenes, 3; paraffin, 0.84; sulfur, 2.08; nitrogen, 0.27. The specimen also contains 806 mg NaCl/l and has an acid number of 0.16 mg KOH/g and a

cokeability of 7 percent by mass. Its potential content of fractions (in mass percent) is as follows: up to 200°C, 2; up to 350°C, 24.4; and up to 490°C, 52.1.

UDC 665.765-404.9:621.892.261

**Influence of Temperature on Structure and Properties of Lithium Soap-Oil Systems**

18410100h Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 1, Jan 89 pp 32-34*

[Article by Yu. L. Ishchuk, L. V. Podlennykh, and B. A. Godun, "MASMA" Scientific-Production Association]

[Abstract] A study is made of changes in the structure of lithium soaps upon heating and cooling and related changes in the viscosity, conductivity, and strength of soap-oil systems. Changes in viscosity, conductivity, and shear strength in lithium soap-vaseline oil are studied upon heating to 230°C and subsequent cooling. X-ray structural analysis of the soaps is performed under polythermal conditions. It is found that both during heating and during cooling LiSt passes through crystalline, liquid crystal, and liquid states, while LioSt passes only through the crystalline and liquid states. This is true both for the pure soaps and for soap-oil systems. Figure 1, references 10: 7 Russian, 3 Western.

UDC 678.664.01:678.046

**Composite Materials Based on Reinforced Polyester Urethane**

18410088a Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 88 pp 19-21

[Article by M. I. Shandruk, Ye. V. Lebedev, I. I. Kostyuk, A. I. Krasnov, and G. I. Pevitskaya]

[Abstract] Polyurethane thermoelastoplastics are promising materials for the manufacture of prostheses. A method has been developed for manufacturing receiving sleeves for prostheses of the extremities by applying layers of a reinforcing material saturated with polyester urethane. The introduction of 15 mass parts of reinforcing material sharply decreases the breaking stress of the specimens. Increasing the reinforcing material to 40 mass parts causes a smooth, continuous decrease in breaking stress. Increasing the content from 15-20 mass parts increases tensile strength, which reaches a maximum at 30 mass parts. Water absorption in 24 hours decreases slightly as a reinforcing material content is increased to 40 mass parts. It is thus possible to adjust the properties of the material by adjusting the content of reinforcing fibers. Figure 1, references 6: Russian.

UDC 678.766-416.019.252

**Shrinkage of Oriented Polyimide Films**

18410088c Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 88 pp 24-26

[Article by S. V. Blasov, A. V. Markov, I. V. Kuptsova, L. N. Guzeyeva, and V. F. Blinov]

[Abstract] A study was made of the shrinkage of oriented polyimide films based on polypyromellitimide type PM-1. Specimens 0.2 by 0.2 m, 40  $\mu$ m thick, were uniaxially stretched on a laboratory installation with automatic recording of the tensile force and relative elongation at rupture. When the polymer is stretched to its plastic limit, there is a sudden change in the configuration of the rigid sections of the polymer macromolecules between the hinge oxygen atoms. This change is accompanied by an accumulation of microscopic reversible deformation. Considering the homogeneous deformation of stresses among the chemical bonds of the macromolecule, it is assumed that this deformation mechanism is predominant in the area of rapid relaxation. The structural changes occurring upon oriented extension of heat-shrink films limit the interval of the films' optimal technological manufacturing parameters. Maximum heat shrinkage in the free state is achieved when they are stretched to the plasticity limit, 25-30 percent stretching, at the minimum temperature. The shrinkage temperature of these films must be significantly greater than the temperature at which they are stretched but less than 673 K. Figures 3, references 10: 8 Russian, 2 Western.

UDC 678.742.3:620.197.6

**Use of Composite Materials Based on Polyolefins as Protective Removable Coatings**

18410088d Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 88 pp 45-46

[Article by V. E. Makaryavichyus and A. N. Machyulis]

[Abstract] A study is made of the possibility of using atactic polypropylenes (which have been formed as a side product in the manufacture of isotactic polypropylene) as the polymer basis for the production of protective removable coatings. A suitable coating material is produced that contains 100 mass parts atactic polypropylene, 11 mass parts dibutylthalate, 17 mass parts foamed diatomite, and 0.5 mass parts diphenyl NN stabilizer. The mechanical and usage properties of the film did not change significantly when they were heated for 7 days to 180°C. Figure 1, references 5: Russian.

UDC 678.686.01:66.085.3

**Radiation-Chemical Structuring of Solid Epoxy Resin and Composites Based on It**

18410088e Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 88 pp 46-47

[Article by V. K. Smirnova, N. A. Kalinina, A. S. Burmenko, V. G. Zadontsev, N. M. Knyazeva, and V. S. Ivanov]

[Abstract] A study is made of some of the properties of a three-dimensional product based on the oligomer EKS-20 and its composites with oligomer EAS-8A. The possibility of sensitizing the process of the radiation structure formation of the oligomer was also examined. Thermal analyses indicated that the initial EKS-20 oligomer undergoes no changes up to 190°C, with the temperature at which a 10 percent mass loss occurs being 280°C. For the radiation-cross-linked product, the respective temperatures are 200 and 305°C. For the cross-linked products produced with radiation treatment of the composite based on EKS-20 and EAS-8A (mass ratio, 3:7), the respective temperatures are 220 and 320°C. The radiation-structured oligomer has excellent dielectric properties and moisture resistance. Radiation cross-linking can be synthesized by introducing maleic acid imide additives. Figure 1, references 2: Russian.

UDC 678.742.21:542.943:546.56

**Solid-Phase Oxidation of Low-Pressure Polyethylene Coatings on Copper**

18410088f Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 88 pp 52-53

[Article by D. F. Lin]

[Abstract] Contact oxidation of polyethylene in the solid phase is studied. The studies are performed on powdered unstabilized low-pressure polyethylene, which was used

to make coatings on copper and aluminum foil substrates by pressing and heating. Oxidation of a 100- $\mu$ m polyethylene coating on copper, in contrast to aluminum, has two stages. They are separated by an autoinhibition stage. Apparently the oxidation during the initial stage of heat treatment results from the catalytic effect of the substrate. Two-stage oxidation is also observed, with contact oxidation in the solid phase apparently a result of homogeneous catalytic action by the copper compounds transferred to the polymers. A transfer of copper into the volume of the coating must be considered in developing coating compositions designed for use at high temperatures. Figures 2, references 9: 8 Russian, 1 Western.

UDC 678.5.067.5.019.74

**Glass-Reinforced Plastic With Increased Chemical Resistance**

18410088g Moscow PLASTICHESKIYE MASSY in  
Russian No 12, Dec 88 pp 54-55

[Article by V. N. Starikova, I. N. Taranukha, and F. I. Broytman]

[Abstract] A study was made of the chemical stability of glass-reinforced plastic based on vinyl ester resin in order to determine the possibility of using GRP equipment in corrosive media to replace steel equipment. Studies were performed in chlorobenzene and acetic and nitric acids at room temperature by using vinyl ester resin specimens that were made by contact molding, cured at room temperature for 24 hours, and then heat treated 3 hours at 80°C. Periodic testing over a period of up to 2 years showed that the GRP had very good chemical stability and is suitable for use in the manufacture of equipment exposed over long periods to corrosive media.

UDC 634.0.813.4

**Variable Acidity as Tool in Creating  
Flame-Resistant Wood and Cellulose Composites**

18410084c Riga *KHIMIYA DREVESINY* in Russian  
No 5, Sep-Oct 88 (manuscript received  
19 Jan 88) pp 70-73

[Article by A. A. Leonovich, Leningrad Wood Technol-  
ogy Academy imeni S. M. Kirov]

[Abstract] It has been shown that flame-retardant systems based on phosphoric acids and organic compounds with basic properties interact with wood complex components by acting as a plasticizer. They support the required degree of hydrolysis of hemicellulose and lignin, stress relaxation in cell walls during pressing, and formation of cross-linked polysaccharide fragments and firmly bonded flame-retardant complexes. It is possible to select flame-retardant substances that yield a neutral product to improve the service life and become acidic when exposed to flame. The composite material itself acts as a buffer, hindering curing. References 6: Russian.

UDC 634.0.813.4

**Study of Wood Product Flame Protection by  
Phosphorus Acid Derivatives**

18410084d Riga *KHIMIYA DREVESINY* in Russian  
No 5, Sep-Oct 88 (manuscript received 26 Oct 87; after  
revision 15 Apr 87) pp 92-94

[Article by Ye. N. Pokrovskaya, T. P. Nikiforova, Ye. L. Geftter, and A. I. Semenova, Moscow Institute of Construction Engineering imeni V. V. Kuybyshev]

[Abstract] A study was made of the influence of several phosphoric acid amides on the flame resistance of wood fiber products. The level of flame protection of the wood

by the phosphorus acid derivatives is found to be determined primarily by the degree of their interaction with the wood fiber, i.e., the content of chemically bonded phosphorus in the wood product. Figure 1, references 8: 7 Russian, 1 Western.

UDC 634.0.813.4

**Toxicity and Combined Effect of Flame-Protected  
Wood Fiber Specimen Combustion Products**

18410084e Riga *KHIMIYA DREVESINY* in Russian  
No 5, Sep-Oct 88 (manuscript received  
19 Jan 88) pp 105-107

[Article by M. V. Yanenko, V. S. Ilichkin, I. V. Gusev, P. A. Evarestov, and N. A. Maksimenko, Leningrad Affiliate, All-Union Scientific Research Institute of Fire Protection; All-Union Wood Processing Industry Scientific Research Institute]

[Abstract] In order to estimate the acute toxicity, determine the significance of the main component, and determine the degree of the combined effect of volatile combustion products, the results of testing 15 flameproofed wood products were analyzed. The specimens were flameproofed by saturation with solutions of preparations based on the principle of the selection of synergistic pairs, thereby creating conditions for the formation of a thin protective antipyrene shell on the surface. It was found that flameproofing wood products improved their thermal stability and generally decreased the potential danger of the liberation of toxic products. When heated to glowing, flameproofed specimens decomposed, liberating more toxic volatile products than when flame burned. The materials tested are highly dangerous, except for specimens flameproofed by the protective shell method, which are at the boundary between highly and moderately dangerous materials. The toxic effect of the volatile products results from their high carbon monoxide content. Figure 1, references 7: Russian.

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